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HELKIAH CROOKE

1684

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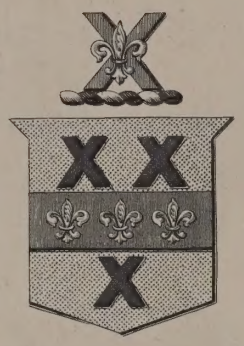

E. BARCLAY-SMITH, M.D.

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ΜΙΚΡΟΚΟΣΜΟΓΡΑΦΙΑ.

46089

A DESCRIPTION of the Body of Man.

TOGETHER VVITH THE CONTROVERSIES and Figures thereto belonging.

Collected and Tranſlated out of all the Beſt Authors of Anatomy, Eſpecially out of Gaſper Bauhinus, *and* Andreas Laurentius. *By* HELKIAH CROOKE *Doctor in Phyſicke, Phiſitian to His Maieſty, and His Higneſſe* PROFESSOR *in Anatomy and Chirurgery.*

Publiſhed by the Kings Maieſties eſpeciall Direction and Warrant, according to the firſt integrity, as it was Originally written by the AVTHOR.

——— Etiam Parnaſsia Laurus
Parua, ſub ingenti matris ſe ſubijcit vmbra.

Printed by W. Iaggard dwelling in Barbican, and are there to be ſold, 1618.

A
DESCRIPTION
of the Body of Man.
TOGETHER
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Dei Gratia Magnæ Britanniæ, Franciæ, & Hiberniæ Regi, Fidei Defensori, &c.

VT suscepti moles operis, cui vix cuiusuis nostrorum hominum vires respondent, & inassueta scriptioni manus, merito me dum rem parrarem deteruêre quo minus Augusto tuo nomini inscriptam vellem; (Rex sereniſſime & tui seculi longe literatiſſime) ita demum conscientia animi integri, sed quorundam, quos minime decuit, obtrectatione tentati, ad eam me impulit rectè factorum fiduciam, vt primum libenter ad tuam Maiestatem prouocauerem, quẽ fælicitas publica cum primis Literaria, non Orbis modo nostri sed & Ἐγκυλοπαιδίας Imperio admouit. Enimuero vt tacem eam quam exteræ Gentes in Tuis egregiè scriptis amant & admirantur πολυαναγνωσίαν; interior illi πολυμαθεῖα quam ante annos aliquot in altera, nouiſſimè in Cantabrigiensi Academia publiciſq; Comitijs sub tuis Auspicijs habitis, signatam exhibuit Maiestas tua; non sinit me dubitare litem hanc de re literaria Tuo Tribunali ordinariè competituram. Duo igitur sunt quæ huic operi affigunt si non affingunt crimina, mihi ipsa tertium. Primum idq; maximum nefat esse ducunt Artis Mysteria ignobili vulgo prostituisse. Secundum velamen Naturæ reuelare, & Pudicitiam quasi in propatulo ponere. Tertium illiberalis esse ingenij arguunt in aliena quercu lignari. Quæ singula quidem amoliri, vt mea plurimum interesse sentio, ita supplex obtestor Maiestatem tuam, pro eo, quo coronatæ incedunt virtutes tuæ, Candore vt tantisper tua tempora demorer dum totidem momentis molumenta isthæc diruam. Atq; primum me mouit non modo scriptorum veterum Græcorum, Latinorum, Arabum recepta consuetudo, qui ad vnum omnes, Artes quisq; suas cuiusuis generis indigitarunt; sed & Neotericorum schola Medicorum, qui Patrio Idiomate vel primum donarunt inventa Anatomica vel postea traduxerunt; cuius rei locuples mihi testis est pars quæque

Europæ maxime literata, Hiſpaniam dico, Gallias, Italiam & vtramq; Germaniam. Neq; vero in noſtra Anglia ſiluit hæc Muſa, aut poſtliminio tantum recepta eſt; ſed ſuperiori ſeculo nata, ſub Patre, Filio, Filia potentiſſimis & literatiſſimis Principibus ter quidē inſtaurata, ſed deſtituta fomentis in Cunis adhuc vagire deprehenditur: ſi quidem vt vrbium Imperiorumq; ita literarum ſua ſunt & lenta tempora quibus oriuntur, florent, ſeneſcunt & tandem intereunt. Taceo illa, maxima quidem, ſed commemorata nobis libro primo rationum momenta, quibus ab vtilitate, a voluptate, a neceſſitate ipſa, quotquot mortalium ſumus, cogimur, trahimur, allicimur in Communionem Naturalis Sacramenti ſummæ Magni Opificis ſapientiæ et bonitatis. Quis ora erecta dedit & oculos verſi-colores? quis narium perforationes & ſinuoſas aurium tornauit Cochleas? quis venarum arteriarumq; riuos & aquæ-ductus diſtribuit, neruorum tetendit rigitatis, oſſium θεμέλιον poſuit, cutis efflореſcentiam & membranarum expanſa dilatauit? quis artus arturumq; digitos diuiſit, firmauit pedes, poros & ſpiracula terebrauit? quis excauavit pulmonum Bronchos ſpirituſq; reciprocationes inſtituit? quis motus cordis geminos; intermediam quietem, & concluſæ vitæ ſubſultationes pulſuq; limitavit? quis viſcerum coagulavit conglomerata Parenchymata? quis Senſuum διοδεύτηρίοις Animæ Regiam ſtipavit, Cerebrum Falce diviſit, arcuatam Concamerationem medullæ, ſpeculumq; lucidum diſpoſuit? quis ſpirituum Animalium diſterminavit conceptacula, reticulum mirabile plexumq; Choroidem innexuit. Dies me deficere ſi ventriculi Chyloſin, inteſtinorum volumina, Meſaraicarum fuctus, hepatis ſanguificationem & Anaſtomoſes mirabiles; ſi lienis defæcationem, renum emulctus, veſicarum collectiones, teſtium irradiationes, vteri ſenſus, & mille artes Naturæ minimis particulis ingenitas prædicem: quæ ſi non ſingula, at præcipua tamen noviſſe, cuius Deus bone! non intererit? Circumgerimus ignota miracula & ſectamur quiſquilias, extra nos querentes dum domi perigrinamur.

At obſignata inquiunt Myſteria Arti reverentiam, Artifici dignitatem pariunt. Scilicet is ſemper mos fuit hominum vel illiteratorum, vel queſtui inhiantium, Religiones Arteſq; tanquam ſcrinio concluſas gerere; ne vel fœdæ argui poſſint inſcitiæ, vel emolumenti tantillum ſibi detrahi ſinant: quanquam ſi legitima virtutis præmia ſpectent, non aliunde cumulatius noſtri ordinis hominibus ſubminiſtrari ſentiant; quam ab ijs, qui vel leviter initiati vanos etiam metus expaveſcunt, vel altius inſtituti fidam Artem vt agnoſcunt, ita cum opus eſt expoſcunt & amplectuntur. Sed ſi neq; veterum calcare viam, nec recentium laudabili inſtituto inſiſtere velint, vt illorum obſequi poſſint voluntati, quos vel diverſa ſtudia vel occupationes a literis alienæ minus idoneos rediderunt qui rigidam Anatomicorum orationem percipiant; at certe juventuti Chirurgicæ ne invideant; qui cum de noſtra Repub. Colonia ſint, equum eſt eas leges, ea jura teneant quibus & ſibi decori & nobis, dum res eſt, vſui eſſe poſſint. Qui idcirco non ingenio Stromatico inſtituendi, aut Cothurnatis Ciſſonijſq; crepidis induendi; ſed per genuina Artis præcepta facili methodo deducendi, vt quæ domi vel ſuo marte, tēporum injuria, vix conſequi poſſunt, noſtra opera ſibi abundè ſuppeditata cognoſcant, eaq; ita mitigata vt poſſint cō coqui. Neq; enim vbiuis

ter-

terrarum Doctores Medici ad sunt, aut Cuiusuis fortunæ est stipendium medicum numerare; an igitur necessum habeant perire eos omnes quorum, vel res angusta vel habitatio à Medicorum frequentia secluſa est.

At saltem secreta Naturæ reuelanda non sunt, neq; auribus oculisue obijcenda quæ male feriatorum mentes & pescant & incendant. Veniunt hic mihi primo loco repetenda quæ dudum adduxi de consilio omnium Seculorum, Nationum, Hominum, quorum nemo harum partiam Historiam detrectauerit; de admiranda Diuini Creatoris in his ijsdem partibus sapientia; de Administrationibus circa easdem necessitate; quæ eo magis vrgere soleat quo symptomata plerumq; inducunt vt grauiora & tristiora ita maxime frequẽtia. Quid quod Scriptura sacra *Rachaelis* Menses, puerpearum profluvia, Carnis saliuationem in Gonorrhœa, semen Concubitus. *Saræ* κεκλεβολὴν σπέρματος quam admodum violenter, inquit *Stephanus*, seminis Conceptionem pro emissione interpretantur, describere non erubit? Quid quod ipsi publicis Dissectionibus non delineatas imagines, sed ipsum Corpus humanum vtriusq; sexus spectandum palpandumq; exhibent, partesq; obscœnas secant resecantq;, in Corona populi, & patrio idiomate singula explicant: quo minus alteri vitio vertant quæ sibi laudi ducunt. At tribuendum est aliquid pudicitiæ. Certe quidem & nos non parum tribuimus, & quoad fieri potuit, re non neglecta quæ sub manibus erat, honestis Circumlocutionibus argumentum molle exasperatum reddimus; vbi proposito inuitendum erat, philosophica disputatione Lectoris mentem in diuersum trahimus, *Ne vati noceat mala lingua futuro.* At Icones sunt plusquam Aretinæ, ita in Theatro Anatomico publicè ad invidiam conciliandum nuperrime nominibantur; quæ non aliæ quam quæ nostro hoc seculo Centies impressœ vbiq; terrarum circumferuntur, pijs Principibus & Rebusp. ap probatæ; non aliæ quam quæ virgini castissimæ *Elizabethæ* sacro-sanctæ memoriæ principi Dedicatæ & in manus traditæ sunt. *Crimine ab vno disce omnes* & frontem tristi censura striatam.

Deinq; dignitatem mihi exprobant Academican quod aliorum vestigijs insistens de alieno prodigus de proprio parcus fuerim. Neq; sane diffitebor me sanguinem succumq; hausisse ex alijs; at Methodum, Limina, Limamq; nostra voco; in super quæ sæpenumero in Disquisitionibus occurrunt partes meas. Addidi etiam plurimorum Anatomicorũ διαχωρίσμους, suffragia, retractationes, demonstrationes, ἐξιδιάσμους: quæ omnia vel colligere, vel collecta repetere vnde desumpta sunt & suis quæq; locis disponere non nudi est Tralatoris; quanquam fuerunt & inter nos sunt viri valde docti quorum diuina ingenia *longe sequor & vestigia semper adoro* quibus transferendi munus fastidio non fuit.

——— Etiam Parnassia Laurus
Parua, sub ingenti matris se subijcit vmbra.

Neq; hoc mihi jure quis audaciæ loco imputauerit si remigem prius esse me velim quã ad gubernacula manus admouerim, neq; socordiæ si pro-

prio

prio vtar remigio. Atq; nisi ego fallor, si quis in hoc curriculo mecum desudauerit & pedem pedi contulerit; sentiet profecto se ἐπὶ ὀλισθηρᾶς ὁδοὺς διοδεύειν ita præcipitijs & præ ruptis anfractibus totus hic ager scatet. Mitto viscerum viam perplexã & spinis obsitam, quæ tot artis proceres collisit: quas vasorum Conjugationes, quæ diuortia, quam implicitas diuaricationes, rimari sequi, & in suos alueos deducere oportet? Musculorum nomina, origines, progressus, implantationes; Substructorum ossium appendices, processus, perforationes, suturæ, harmoniæ, gomphoses, diarthroses, synarthroses, enarthroses, arthroidæ, ginglymoi; eorundem synchondrosis, synsarcosis, syndesmosis, & mille tedia superanda sunt; immensum æquor arandum, antequam fugientem oram prehẽ-henderis. Ne igitur mihi fraudi sit easdem horas his studijs insumere & publicæ vtilitati consecrare, quas alij, qui magnæ potius quam bonæ famæ sunt; inter globulos & fumum prolixe disperdunt. Artem tracto tentatam quidem ante me, sed subsultim & leui pede, ab ijs quorum voluntates probaueris potius quam facultates, qui tamen cum primum ad vexillum fuerunt, merito suo Primipili à me audient. In nostro opere fidem invenies & indefessam diligentiam; orationem, non illam quidem ornatam, qui poteram in abrupta re? sed evidentem & dilucidam; verborum etiam delectum, sed non tam quæ delectent quam quæ instruant, quamquam & ipsa Artis vocabula adiunximus, sed reddita, vt apud me lector leiplum, apud alios iltos ipios intelligat.

Atq; hactenus consilij mei rationem ita vt teneor expossui, quod vt Majestatis tuæ bona cum venia sit humillimè & obnixè contendo. Faueas primitijs crescentis indolis; quæ si sub tuo Sole adoleuerit & iustam tandem maturitatem consequuta fuerit, non indignos fructus retributarum confido. Interim a Te pro meo opere ἄδειαν, pro Te a Deo Opt. Max. πολυπλασιευδαιμονίαν supplex efflagitabo.

Sereniſſimæ Majestati tuæ

Subditus Deuotiſsimus,

HELKIAH CROCVS.

The Table of the seuerall Chapters and Questions contayned in this *whole Volume.*

The first Booke.

CHAP. I.

THE Excellency of Man is declared by his parts, namely the Minde and the Body, and first what is the dignity of the Soule. Folio 3.

Chap. 2. Of the wonderfull frame of Mans body. Folio 4.

Chapter 3. *Epicurus, Momus, Pliny* and other, the malicious and false detracters from nature are censured, &c. 8.

Chap. 4. Wherein the body of Man differeth from other creatures, &c. 10.

Chap. 5. How profitable Anatomy is vnto euery mans selfe. 12.

Chap. 6. How profitable Anatomy is to the knowledge of God. 14.

Chap. 7. Howe profitable Anatomy is to Philosophers, Artificers, and Handy-craftsmen. 15

Chap. 8. The necessitie of Anatomy for Physitians and Chyrurgions. 15

Chap. 9. With what method Anatomy may be best demonstrated. 17

Chap. 10. Who haue writ of Anatomy. 20

Chap. 11. What *Galen* hath written of Anatomy, and how he was vniustly accused by *Vesalius*. 22

Chap. 12. How far *Aristotles* skill streatched in Anatomy. 24

Chap. 13. What other Greeke authours haue written of Anatomy. Ibid.

Chap. 14. Who haue bin the chiefe authours of anatomy in our times. 25

Chapter 15. The instruments necessary to anatomy. 26

Chap. 16. What is the subiect or immediate obiect of anatomy. 27

Chap. 17. What an Anatomist must consider in euery part. 28

Chap. 18. The differences of parts, &c. 30

Chap. 19. A diuision of parts, &c. 31

Chap. 20. An elegant diuision of parts into similar & dissimilar, &c. 32

Chap. 21. The other differences of the parts vnfolded. 34

The Controuersies of the *first Booke.*

QVEST. I.

THE definition of a part. *Folio* 38

Queest. 2. *The principality of the parts against the* Peripateticks. 39

Qu. 3. *How many principall parts there are.* 43

Qu. 4. *Of the nobleſt principall part.* 45

Qu. 5. *Of Similar and Disimilar parts.* 47

Qu. 6. *Whether a Similar part may be called Organicall.* 48

Qu. 7. *Whether the Spermaticall parts be generated of Seede.* 50

Queſt. 8. *Whether the Spermaticall parts can reioyne againe after they be violated & seuered.* 54

Qu. 9. *Whether the ſpermaticall parts be hotter then the fleſh.* 57

Queſt. 10. *Whether the ſolid parts become dryed can be made moyſt againe.* 59

The second Booke.

CHAP. I

THE diuision of the body of man. Folio 62

Chap. 2. The diuision of the lower belly. 64

Chap. 3. Of the composition or frame of the lower belly. 65

Chap. 4. Of the haires of the whole body. 66

Chap. 5. Of the cuticle or scarse-skin. 70

Chap. 6. Of the Skinne. 71

Chap. 7. Of the Fat. 73

Chap. 8. Of the fleshy membrane. 74

Chap. 9. Of the inuesting or containing parts proper to the lower belly. 76

Chap. 10. Of the *Peritoneum* or rim of the belly. 77

Chap. 11. Of the vmbilicall or Nauell vessels. 78

The Controuersies of the *second Booke.*

QVEST. I.

HOw the hayres are nouriſhed. *Folio* 82

Queſt. 2. *Whether the skinne bee the organ of touching.* 84

¶ *Queſt.* 3

3. *Of the temper of the Skin.* 85
4. *Whether the skin performe any common and officiall action.* *Ib.*
5. *Whether it be heat or cold wherby fat is congealed.* 87
6. *Whether fat be a liuing and animated part of the body.* 90
7. *Of the membranes, vse and production of the Peritoneum.* 91
8. *A new kinde of compunction of dropsie bodies through the Nauell.* *Ibid*

The third Booke.

CHAP. I.

Of the Naturall partes contayned in the lower belly. 95
2. Of the *Omentum* or kall. 96
3. A briefe description of the gate veine and his branches. 99
4. The arteries of the stomacke and the mesentery, which accompany the braunches of the Gate-veine. 101
5. Of the Guts. 103
6. Of the mesentery. 111
7. Of the *Pancreas* or sweet-bread. 113
8. The branches of the hollow veine and great artery. 114
9. Of the stomacke. 116
10. Of the *œsophagus* or gullet. 122
11. Of the spleene or milt. 124
12. Of the Liuer. 129
13. Of the bladder of gall. 135
14. Of the Kidneyes. 139
15. Of the *vreters* or passages of vrine. 149
16. Of the bladder. 150
17. Of the Fundament. 154
18. The muscles and nerues situated in the lower belly. Ib.
19. The bones of the lower belly. 155
20. Of the breast or paps. 156

The Controuersies of the third Booke.

QVEST. I.

VVHether the Guts haue any common attractiue faculty. 161
2. *Whether the guttes haue any common intractiue faculty.* 163
3. *Whether the guts haue any concocting faculty.* 164
4. *Of the expulsiue vertue of the guts.* 165
5. *Whether Clisters can passe vpward vnto the Stomack. Folio.* 166
6. *Of the euill sauour of the excrements.* 167
7. *Of the substance and scite of the Guts.* 168
8. *Whether the vpper mouth of the stomacke be the seate of appetite.* 169
9. *The situation of the vppermost mouth of the Stomack. Fol.* 170
10. *Whether the* Chilus *be made by heat or by the form of the stomacke.* *Ibid*
11. *Whether the stomacke bee nourished by the* Chylus *or by bloud.* 171
12. *What is the nature of a spirit, &c.* 173
13. *Whether the bladder doe drawe the Choller vnto it for nourishment.* 176
14. *The passages by which the Choller is purged, against* Falopius. 170
15. *The vse of the Spleene against the slaunderous calumniations of* Galens *aduersaries.* 181
16. *How the melancholy iuyce passeth from the spleene to the bottom of the stomacke.* 185
17. *How those that are spleenitick are purged by vrine, &c.* 186
18. *Vse of the Kidneyes, and matter of the vrine.* 187
19. *That the reasons of diuers Symptomes which followe such as are afflicted with the stone are to bee required for Anatomy.* 189
20. *Whether the bladder do draw the vrine.* 191
21. *Of the Retention and Excretion of the vrine, &c. Fol.* 192
22. *Of the action and vse of the Pap.* *Ibid.*
23. *Whether milke can bee generated before conception. Fol.* 193
24. *Certaine Problemes vnfolded concerning the generation of milke.* 194

The fourth Booke.

CHAP. I

OF the necessity of the parts of Generation. Folio. 199
2. Of the preparing spermaticke or seed vessels. 200
3. Of the *Parastatæ.* 202
4. Of the Testicles. 204
5. Of the vesselles called *vasa deferentia*, or leading vessels. 207
6. Of the bladders of seed. 208
7. Of the *Prostatæ.* 209
8. Of the virile member. 210
9. Of the proportion of these parts both in men & women. 216
10. Of the preparing spermaticall vessels. 217
11. Of the Testicles. 218
12. Of the *vasa deferentia* or leading vessels. 220
13. Of the wombe or matrix. 221
14. Of the simple or similar parts of the wombe, & particularly of the bottom and orifice. 230
15. Of the necke of the wombe and of the *Hymen. Fol.* 234
16. Of the Priuities. 237
17. Of the wombe of a sheepe and a dog. 239

The Controuersies of the fourth Booke.

QVEST. I.

VVHether the Testicles be principall partes or no. 241
2. *Of the vse of the Testicles.* 243

The twelfth Booke.

CHAP. I.

OF the definition, vse, and difference of gristles. Folio. 907
2. Of the gristles of the Face. 909
3. Of the *Epiglottis*, the Gristles of the *Larynx*, and of the weazon. 910
4. Of the gristles in the trunke or bulke of the body. 612
5. Of the gristles of the Ioynts. 913
6. Of the nature, vse, and differences of Ligaments. Fol. Ibid.
7. Of the ligaments of the head. 915
8. Of the ligaments of the spine and the chest. Ibid
9. Of the ligaments of the shoulder blade, the arme the cubit, and the wand. 916
10. Of the ligaments of the wrest, afterwrest & the fingers. 917
11. Of the ligaments of the Holy-bone, the haunches, and the whole leg and foot. 918
12. What a membrane is, their vses and differences. 920
13. A briefe enumeration of all the mẽbranes. 922
14. The nature of fibres. 923
15. Of the differences of fibres. Ibid.

The 13. Booke.

CHAP. I.

OF the definition and difference of bones. 926
2. Of the partes of bones and their appellations. 928
3. Of the structure and connexion of bones in generall. 930
4. A briefe definition and enumeration of all the bones in the body. 935
5. Of the sutures or seames of the scull, and of the substance thereof. 936
6. Of the proper bones of the scull. 940
7. Of the bones that are common to the head & the vpper Iaw, that is to say, of the wedge & spongy bones. 946
8. Of the bones of the nose, & of the yoke bone 950
9. Of the sutures and seames of the vpper Iaw. 951
10. Of the bones of the vpper Iaw, 953
11. Of the lower Iaw. 956
12. Of the sockets of the teeth. 958
13. Of the name, definition, figure, magnitude, nũber, site, and articulation of the teeth. 959
14. Of the shearers and Dog-teeth. 961
15. Of the grinding teeth. 962
16. Of the vessels and sence of the teeth. 964
17. Of the inward cauity and membrane of the teeth. 967
18. Of the generation and vse of the teeth. 968
19. Of the bone *Hyois* called *os gutturis*. 971
20. Of the spine in generall. 973
21. Of the rackebones of the necke. 975
22. Of the rackes of the backe, the loynes and the holy-bone. 976
23. Of the bones of the chest in generall. 980
24. Of the clauicles or coller-bones. Ib.
25. Of the breast bone. 982
26. Of the Ribbes. 983
27. Of the shoulder blade. 984
28. The hip, hanch and sharebones. 985
29. The bones of the arme and the cubit. 987
30. Of the bones of the hand properly so called, that is, of the wrest and afterwrest. 991
31. Of the bones of the fingers. 994
32. Of the Seed-bones. 995
33. The bones of the thigh. 996
34. The two bones of the leg. 999
35. The whirlebone of the knee. 1003
36. The bones of the Foote properly so called, and particularly of the wrest of the foot. 1004
37. The bones of the afterwrest, & the Toes of the feet. 1008
38. Of the Seede bones and the nayles. 1009

The twelfth Booke.

CHAP. I.

1. Of the definition, vſe, and difference of griſtles. Folio. 907
2. Of the griſtles of the face. 909
3. Of the Epiglottis, the Griſtles of the Larynx, and of the weazon. 910
4. Of the griſtles in the trunke or ſtocke of the body. 913
5. Of the griſtles of the ioynts. 913
6. Of the nature, vſe, and difference of Ligaments. Ibid.
7. Of the ligaments of the head. 914
8. Of the ligaments of the ſpine and the cheſt. Ibid
9. Of the ligaments of the ſhoulder blade, the ſame the cubit, and the wand. 916
10. Of the ligaments of the wriſt, afterwriſt & the fingers. 917
11. Of the ligaments of the Holy-bone, the ſhank-bone and the whole leg and foot. 918
12. What a membrane is, their vſes and differences. 920
13. A briefe enumeration of all the membranes. 922
14. The nature of fibres. 923
15. Of the differences of fibres. Ibid.

The 13 Booke.

CHAP. I.

1. The definition and difference of bones. 926
2. Of the parts of bones and their appellations. 928
3. Of the ſtructure and connexion of bones in generall. 930
4. A briefe definition and enumeration of all the bones in the body. 934
5. Of the ſutures or ſeames of the ſcull, and of the

ſubſtance thereof. 936
6. Of the proper bones of the ſcull. 940
7. Of the bones that are common to the head & the vpper law, that is to ſay, of the wedge & ſtyp-
ey bones. 945
8. Of the bones of the nofe, & of the yoke bones. 950
9. Of the ſutures and ſeames of the vpper law. 951
10. Of the bones of the vpper law. 953
11. Of the lower law. 956
12. Of the ſockets of the teeth. 958
13. Of the name, definition, figure, magnitude, nu-
bor, vſe, and articulation of the teeth. 959
14. Of the forers and Dog-teeth. 961
15. Of the grinding teeth. 962
16. Of the veſſels and ſence of the teeth. 964
17. Of the inward cauity and membrane of the
teeth. 965
18. Of the generation and vſe of the teeth. 968
19. Of the bone Hyoi called of ſome. 971
20. Of the ſpine in generall. 973
21. Of the ſeuen bones of the necke. 975
22. Of the ſtalke of the backe, the ioynes and the
holy-bone. 976
23. Of the bones of the cheſt in generall. 980
24. Of the ſtanleſs or collar-bones. Ib.
25. Of the breaſt bone. 982
26. Of the Ribbes. 983
27. Of the ſhoulder blade. 984
28. Of the hip, hanch and thigh-bone. 985
29. The bones of the arme and the cubit. 987
30. Of the bones of the hand properly ſo called,
that is, of the wriſt and afterwriſt. 993
31. Of the bones of the fingers. 994
32. Of the Seed-bones. 995
33. The bones of the thigh. 995
34. The two bones of the leg. 999
35. The ſmall bone of the knee. 1002
36. The bones of the Foote properly ſo called, and
particularly of the wriſt of the foot. 1004
37. The bones of the afterwriſt, & the Toes of the
foot. 1004
38. Of the Seede bones and the nayles. 1005

TO THE VVORSHIPFVLL Company of the Barber-Chyrurgeons, the *Maister, Wardens, Assistants, and Comminalty of the same;*

HELKIAH CROOKE, Physitian and Professor in Anatomy and Chirurgery to His MAIESTIE, *wisheth Happie and prosperous Successe in Your* PROFESSION.

MY Maisters and Worshipfull Friends. As from the first I intended this Labor vnto your behoofe; so now hauing by Gods assistance brought it to an end, I offer it vnto you as a token of my Loue: Not that I doubt but there are some among you who as themselues stand in no neede of my helpe, so they are also able to haue set out this Banquet with greater variety and to haue Cooked it fitter for you as being better acquainted with your diet and appetites. But because it is now a long time since your *Banister* (that good old man) first presented you with a seruice of this kinde, and no man hath seconded him; I haue aduentured to commit vnto you these first fruites of my vntainted fame: which if you shall kindly entertaine and make such vse thereof as I may not think my labour misbestowed, you shall encourage me cheerefully to run on that course which I haue propounded to my selfe to further your profiting in that Noble Art which you haue taken vpon you to professe. For when I first began, I intended the Anatomy to be but an entrance into a worke of Chyrurgerie, which I had digested into a forme fit, as I thinke, first to ground and establish you in the Principles and Theory or Contemplatiue part of your profession, and after to builde you vp vnto the practise of the same. And becaus̃e the Body of Man is the Subiect of your Art, without the knowledge whereof it is impossible for a Chirurgeon to work with any confidence or certainty of successe, I began with Anatomy.

In the next place shall follow a Discourse of the constitution of mans body, as he enioyeth a perfect or apportionated health by a due Mixture of the principles whereof he consisteth; of the Temperament of each part arising from that mixture; of the Offices or Functions proceeding from that temperament, and such other things as will fall in with the same. For as it is a rule in Geometry, that *Rectum est index sui & obliqui, That which is Right measureth both it selfe and that which is crooked*; so in our Art, he that knowes what should bee the naturall disposition of euerie part will be best able to iudge when Nature declineth from that integrity, and how far the declination is from the true and genuine constitution. This part indeede is Philosophicall, but I shall make it so plaine, if God will, that a very reasonable capacity shall be able to apprehend it. After you haue knowledge of the healthfull and sound constitution which is the rule of the rest, I teach the Natures, Differences, Signes and Prognosticks of diseases, so farre as it necessarie a Chyrurgeon should know, that is to say, of Tumours or Apostemations, of Woundes, Vlcers, Fractures, and the like. Then followeth the Method of Curing by Indications, which are many and intricate, but I haue referred them (not without great labour) to outward diseases and illustrated all by examples to make the better impression in your minds. In the next place I handle the Operations of Chyrurgery in generall, where you haue all the Instruments of your Art; Engines, Swathes, Ties, Bands and Ligatures, described by *Hippocrates, Galen, Oribasius*, and those also of the new Chyrurgeons inuentions, with their Figures, interpretations, and manner of application. Afterward I descend to the operations in particular, as to Diuision, Simple & Compond; Simple in Section & Vstion; Compound with Extraction and Extirpation. To Iunction also, Simple and Compound, Simple in Adduction, Adaptation, and the way how to Conteine them so fitted together. Compound with Addition of such decayed Naturall parts as may bee restored or imitated by Art. Then I come to the cure of Tumors of all kindes both Simple and Compound; of Wounds whether they bee made *Cæsim* or *punctim*, by Contusion, by Arrowes, Engines or Bullets, with Laceration or without: of the bytings or stinging of venomous Creatures, with their seuerall Antidotes: of burnings, scaldings, and such like.

Next I proceed to Vlcers, putride, sordide, fistulated, cancerous, gangrenated, sphacelated

and such as are virulent, with the Accidents that vse to accompany them: to Luxations also and Fractures with their kinds and accidents. Afterward I handle those generall diseases which belong to the whole body, as the Gowt, the Leprosie, the Meazels, the Pox of both kindes, the Plague and such like: and then proceede to the particular diseases from the Head to the Foote, wherein the Chirurgeons helpe is required. Finally, I intreat of the Matter of Chyrurgery, that is, of the Nature of those Drugs, Hearbs and Minerals which he hath neede to vse; of their correction and preparation, of the manner of compounding his Medicines both for outward applications and such inward as may conduce thereuuto. And so I thinke I shall haue finished the Art of Chyrurgery throughout.

I acknowledge that which I haue promised to be a great labor, and more then any man whom I haue yet seene hath accomplished: but the ground being long agoe laide in my priuate studies and references continually now for these sixteene yeares accommodated vnto those groundes, haue brought it to such forwardnesse as I can be content to finish it with as much hast as my occasions will giue leaue, if I see that this Anatomicall labour is acceptable and of vse vnto you. I know well there are some who thinke and do not sticke to affirme, euen before your publique Assemblies, that you haue meanes enow already, & naply more then they would you had. Their reason can be no other, but because they would holde you alwayes obnoxious to themselues. For my part I conceiue of the Art of Chyrurgery as of a part of Physick; and therefore of Chyrurgeons as Citizens of the Physitians Commonwealth: the difference is, that wee hauing mostwhat better meanes by education to aduantage our wittes, apply them vnto the more abstruse part of the Art separated from the sense and consisting in contemplation and collection; the Chyrurgeon worketh by his eye and with his hand, and dwelleth as it were in the Confins of that Countrey whose inner part we inhabit. If therefore they warrant the frontiers and keepe their Stations well and duly therein, may not we better attend to improoue the portion that is allotted vnto vs? But wee are both like couetous Farmers, who incroach vppon and get more grounds into their hands then they can well manage, forgetting that wholesome counsel of the wise Poet:

Laudato ingentia rura—Exiguum colito. *Praise a great Farme but occupy a small.*

For surely if we aduise well with our selues, Physitians shall find work enough (though they meddle not with the labour of the hand) to minde the subiect of their Art, I mean Anatomy, wherein too many of vs are wanting to our selues and others; the causes of diseases; the signes of the part affected; the skill of prædiction; the method of curing and the choise of Medicines, with a world of intricate worke beside in apprehending occasions, expecting and imitating the motions and endeauors of Nature, remooving her obstacles, strengthning her operations & the like. And if we want imployment in these, it seemeth to me more fit to fit our selues thereunto, then casting behinde our backes the care of such needfull studies to take vp our precious time in dressing or attending broken heads, strained or luxed ioynts, new wounds or old Vlcers, or in playing the Apothecaries as some do, who vnder the name of Cordials of x. li. an ounce, Potable Golde, precious Quintessences and preparations of Minerals, do obtrude vpon the worlde either notable impostures or dangerous poysons, ayming indeede at nothing so much (if at any thing else) as at their priuate gaine and the concealing of their ignorance which would necessarily be detected if they should communicate their practise to Apothecaries as other ingenuous Physitians doe. But of these I haue spoken more largely in an Animaduersion vpon *Crolius* his Admonitory preface in Latine, and shall haue fitter occasion to speake more elswhere, when I shall be very plaine against those that come in my way.

To returne whence I haue digressed. *Hippocrates* the Father and Author of *Physicke*, the true paterne of ingenuity, put that for one clause in the Oath which himselfe solemnly tooke, and which he would haue all Physitians take, that they should not cut any man for the Stone, but leaue that worke for them that accustome themselues to performe it; by that one instance according to his custome, interdicting a Physitian all manuary labour as knowing he should finde worke enough to fit his minde for greater difficulties. On the other side the Chyrurgean should content himselfe with the limits of his profession and not vsurpe vppon the possession of the Physitian, which he doth (somtimes indeede for his profit) but seldome without the detriment of the patient, especially if there be any difficulty in the businesse. I do not deny, but that a Chyrurgeon, yea a Diuine, or Gentleman, if he lay good foundations and build therafter vpon them may be a Physitian as well and as good as the best of vs: but it is not ordinary for men of Manuary Trades or other professions to be so qualified: the more honour it is for them that bee. But certainly if euery man would containe himselfe within his own tether, and presse no further then he is guided by right reason and his reason warranted by experience, we should not heare of so many solœcismes and notable incongruities which are daily committed, nor some (otherwise worthy men) be marked with the blacke coale of filthy auarice, the basest and most preiudiciall vice that is incident to learned men.

Neither yet do I thinke it fit, that the Physitian should be ignorant in the Chyrurgical part, but able to guide the Chyrurgeon that is not able to guide himselfe, to assist and confirme him that is, and to amend a fault when it is committed: but for the work of the hand, I take it to be more lawfull for him then expedient, more honourable to be able and not to do it, then profitable to do it though he be neuer so well able. Albeit to say the truth, the fault is more common on the Chyrurgeans part then on the Physitians; and by so much the greater, by how much the danger

of

of not doing well is more in very many, then the disreputation or disaduantage can be to a few (and very few they be indeede of the better sort) who do all they can.

Notwithstanding, becausse some men are importunately bolde aboue their skill, shall it not be thought fit that all may learne that they ought to haue skill in and is an essentiall part of their profession? Let them then learne it (saith the Physitian) as we do. As much as if he should say to his patient that is not able to helpe himselfe: There is an excellent Medicine for your malady in *Galen* I pray you seeke it out. It is indeede a disease in our common-wealth, that Chyrurgeons haue no better meanes to instruct themselues; but such a disease as (among the rest) is verie behouefull for the Physitian. For sure I am, if they had those meanes that wee haue, they would easily (as it is in the prouerbe) wipe the fat from our beards; not only becausse of their nũbers, but especially becausse they are interessed alwaies in a part of our profession: so that if they were as wel able as willing to take vpon thẽ the whole, we should be faine either to conuert our studyes some other way, or feed vpon their leauings which would be but short Commons. If therefore you will say they meddle so much now, what will they not vndertake when they are better prouided? Surely not so much: for who are those that busy themselues most in the matter of physicke, but such as are least able. The able and discreet Chyrurgeon when hee hath learned anie thing hath also learned the difficulty of physicke, and will bee readier to pray in aide of the learned Physitian, then he that runs boldly headlong without foresight of danger.

Seeing therefore it is necessary Chyrurgeons should be instructed for the behoose of the Commonwealth, whose generall good is to be preferred before all particulars; why should we not be rather willing to instruct them our selues when we may holde them within the compasse of their owne Art, then driue them to seeke other helpes to our preiudice? Now then, among all the parts of our Art there is none that the Chyrurgeon hath more need of, or that is of more vse for himself then Anatomy, none that doth lesse inable him to practise physick, it being a mere Natural study, teaching him where to seek the Veine hee must open; how the ioynt should bee reposed which he findeth luxed; what parts are nere the wound which he searcheth and therefore may be offended with it; which way the Fibres, Vessels and Tendous run that in his incisions he may not violate them; how to cast on his Bands to conteine a Fracture or Luxation; how to auoide the most sensible & vsefull parts in Trepaning, Cauterizing, dismembring and such like: but of medicine and the cure of inward diseases in Anatomy not a word. The inward parts are also indeed Historified, whose position at least (you will grant vnasked) it is fit the Chyrurgeon should know; else when we appoint a plaister to the Liuer he may lay it to the left side, when for the Spleen on the right. But he may be directed. That is not perpetual; Physitians are not in all places, nor al men fit to entertaine them when they are to be had. Beside, a Chyrurgeon should not alwaies bee an apprentice, but at length a Maister of his Art, fit to instruct others not alwaies standing in neede of instruction himselfe, vnlesse it be in difficulties, when I know no Physitian but will be glad of assistance. Add hereto, that al Physitians, in all ages, kingdoms and free states, haue written their Anatomy and Art of Chirurgery in their mother-tongues, or afterward translated them for the vse of Chyrurgeons; which is so wel knowne that it were in vaine to make repetition of particulars. To come to our selues; we finde many examples of learned men and good Patriots, who haue bene willing to take great paines and to be at great Charge for this purpose.

Amongst the rest D. *Cawdwel* sometimes President of the Colledge of Physitians in *London*, first translated *Moores Tables*, and (a learned man though he were) was not ashamed to do that seruice to his country as to make himselfe, as some vnworthily and scornfully terme it, *A bridge for asses to passe ouer by*. He also promised *Oribasius de Laqueis*, which his labor seemeth to haue bene interrupted by his death or otherwise lost, to the great detriment of Chyrurgery. But for Anatomy he did not onely take paines in it, but was also at great cost to cut the Figures in Brasse, which he left remaining in your hands (my Maisters of Chyrurgery) as a testimony of his great desire to further your profiting in that part. Moreouer that honorable person the Lord *Lumley* erected a Chyrurgery Lector in the Colledge of Physitians, allowing liberall maintenance to a Doct. of Physick to read the same twice a weeke, partly in Latine, and partly also in English for the vse of the Chyrurgeans, and to go ouer the whol body of Anatomy euery year a part; which Lecture is not so duly followed and frequented, as it is performed at this time by D. *Danies*, of whom I cannot but make worthy mention hauing receiued not onely great contentment but profit also by his learned readings. You haue also among you a laudable custome to procure a Doctor of Physick to read vnto you, and to prouide that his Lectures be duly attended by those of your society: and the Physitians, I doubt not, thinke they haue done wel in singling out a learned man to instruct you. Onely your care must be, to feed vpon that rather which is ἐδεσμα, then vpon that which is ποτὸν, vpon that which is good for nourishment rather then vppon that which will delight and fill but not feed your minds: to attend the plaine-song rather then the diuision or descant, which doth oftentimes corrupt the Musick if the auditors eare be not careful to distinguish them. Finally, you haue Anatomies both priuate for your profiting & publick for the honor & reputation of your Company read in your Mothertoong. And truly me thoght it did me good to see so graue a company of gowned Chyrurgeons attending vpon it, so good order, so great a Crowne of worthy Auditors, so liberal entertainmenr at it: which I do not mention to flatter you, for flattery is to attribute more then desert, but partly to commend your praise-worthy care; partly if it were posible to stir vp our selues to a lawfull emulation.

To returne. These many paternes, these worthy presidents first warranted me, after perswaded me to spend those houres which I might spare from my employments in these & the like labors.

For

For which as I esteeme my owne profiting to be a sufficient & answerable reward, so I did & do hope that my paines being communicated to others would returne vpon me with aduantage; that aduantage I meane, which is most welcom to honest minds, that is, a conscience of hauing improued though but a single talent. It were in vaine to Apologize for my selfe that I haue not had that time, those opportunities, those meanes which are required to an exquisit Anatomist, because (it may be answered) I might then haue held my hand and giuen way vnto such as had them. There is indeed a time when a man should stand much vpon the consideration of his strength. There is also a time wherin it is lesse dishonor to want power then will, ability then good endeuour. He that first scales the battlements of a Castle or Citadel though his body bee not sufficient to oppose against a whole squadron, yet if hee win the wall and make way for the victor, deserues a Murall Crown. Whilst other men (put case) more able, haue looked on & pittied themselues, I haue giuen the onset, with courage enough if not too much, *& vini peruenimus*; but with what dexterity is in you to iudge. Many obiections are made against me. First, that being a professed Scholler I should haue written in Latine. That indeed had bene easier for me by far, hauing the words made to my hands, the passages chalked out, and plenty of Authors to haue gleaned from and a litle latine, such as it is to haue varied my discourse: but it had bin most ydle, my purpose being to better them who do not so wel vnderstand that language. I shold, said another, haue made an Anatomy of my owne. Such Guls little know what it is to write an Anatomy; thirtie yea forty yeares practise (which are more then the daies of my life) in dissection, and a hundred bodies more or lesse, small and great euery yeare, hath bin thought little enough to make an Anatomist fit to teach this learned age; for which I dare boldly say, no man amongst vs that knowes himselfe can esteeme himselfe sufficient, because we want those meanes which other Countries affoord their professors. Another closeth more cunningly with me, *Surely it is well done if it were well to do it.* Such limited and reserued commendations I disavow; my reason is, because whilst they commend the beautie of the wall they vndermine and demolish the foundation. My counsell and end that by my right I require should be approued, my performance not so: what greater tort or wrong can there be, then to take a man by the beard with the one hand to kisse him, and to smite him vnder the fift rib with the other & spil his bowels vpon the earth. The Figures are obscoene as *Aretines*. A shameless accusation; for they are no other then those of *Vessalius*, *Plantinus*, *Platerus*, *Laurentius*, *Valuerdus*, *Bauhinus*, and the rest; no other then those which were among our selues dedicated to three famous Princes, the last a Mayden-Queene. For my adding the History of the partes of Generation, I haue already giuen account, partly to his Maiesty, partly in my Prefaces to the fourth and fift bookes. To leaue these men to their contradictory and detracting spirits, I returne vnto my selfe. My present worke is for the most part out of *Bauhine* for the History, Figures, and the seuerall Authors quoted in his Margents. The Controuersies are most what out of *Laurentius*, with some additions, substractions and alterations as I thought fit and my wit would serue. The Method I haue altered throughout, transported the Tables as seemed best vnto me, reuised and made choise of the quotations in *Bauhine*, and interposed them in their owne places. I also added Præfaces to euery booke conteining the argument and purport thereof: & in the subsequent discourse many passages partly out of my owne obseruations, partly as I met with them in approued authors. The streame and current of *Bauhines* discourse because it is very hard, intricate, and full of long continued sentences, I haue broken off and parted as it might best be vnderstoode, which was one thing that made the volume to swell. The words of Art most what I haue kept that you might not be vnacquainted with them, yet haue I also rendred them as well as I could into our language.

The first booke is almost wholy out of *Laurentius* sauing for some passages, so is the fift, and had not the bulke of the volume growne too great, and so too chargeable to the Printer, I intended beside these thirteene Bookes; one of the Dissecting of Liuing Creatures; another of those things which happen rarely in Anatomy: a third of the method of Anatomy, the grounds whereof I had from that excellent and oculate Anatomist *Petrus Pauius* of *Leyden* my Maister and moderator in Anatomy, intreating of the choise and preparation of the bodye to be Dissected, of the Complements and endowments required in an Anatomist, of the place fit to make Dissection in, the manuarie Instruments named onelie in the first booke; the manner and order of dissection; how the parts do arise, where to finde them, and againe to repose them in their owne places before they be offered to the spectators and Auditors, and finally howe to prepare and compose the Scheleton; all which you may haply light vpon hereafter. Heere you haue the worke perfected, not onely as *Bauhine* hath it in three Venters & the Ioynts, but also after those, the kinds of Flesh, Simple, musculous, with the exact story of the Muscles thoroughout the whole bodie, the flesh of the Bowels and the Glandules. In the next place, the Vessels, Veines, Arteries and Sinnewes, with their diuarications and diuisions from their originals euen to the extreme parts. Then the Membranes Ligaments, Gristles and Fibres. And lastly, that cragged and rockie treatise of the Bones. In all which I haue added the Natures and Definitions of euery particular and the explications of them: their differences and diuisions with their Vses and Actions; all which are omitted by *Bauhine* in his Theater, but supplyed by me, partly out of *Laurentus*, partly out of those Dictates I gathered from *Petrus Pauius* before named. Finally, betwixt the 7 booke which contained the history of the vpper Venter that is the Head, and the ninth of the Ioyntes, I haue interposed a Booke of the Senses, collected out of *Bauhine*, *Laurentius*, and *Iulius Casserius Placentinus*, who wrote very accurately of that subiect, many of whose disputations I haue also added. One thing I craue pardon for aboue all the rest, and that is *Placentinus* his Præface before the Controversies of the eight booke, which indeede was not done by me, & the matter it selfe, to say truth, I do not so well like. Again, although I reuised the Presse, or rather the sheets & proofes, as they call them, my selfe; yet being sometimes out of Towne about my practise, & oftner though in towne yet necessarily called away from attending the correction, many literall faults haue escaped, especially in the Greeke, and some more then literall, yet few such as will stumble the Reader, and fewer, it may be, then could be imagined should escape a worke of such vncouth argument to the Compositors, and written besides in a Schollers running hand. Thus much I thought good to aduertise you of, my kinde and VVorshipful Friends, and so to commend my labor to your good acceptance and your honest endeavors and studyes in this and other parts of your Art to Gods blessing. *From my house in S. Annes Lane, this last of May*, 1615.

By your Louing Friend HELKIAH CROOKE.

OF THE EXCELLENCIE OF MAN.

Together with { *Profite, Neceſsitie,* } { *Antiquitie, & Method* } *of* ANATOMY.

As alſo, of the *Authors, Subiect,* and *generall Precepts* of the ſame.

THE FIRST BOOKE.

The Præface.

THE worth and Excellencie of an Art, is greater or leſſe, according to the dignity or baſeneſſe of the Obiect, whereabout it is conuerſant. So in the ἐγκυκλοπαιδείᾳ, that is, the Orbe or Circle of the Arts, *Logicke* is worthily eſteemed the firſt in order, becauſe the obiect thereof is *Reaſon*; whereby (as by *Ariadnes* clew) wee are directed through all the intricate Labyrinths and Mazes of Nature; and *Diuinity* the laſt and moſt excellent, as beeing the end and conſummation of all the reſt, teaching vs how to liue bleſſedly both heere and for euer: and therefore though all Arts are indeed originally from God, yet this is ſaide more properly to be ἄνωθεν καταίρχομένη, becauſe it is immediately deliuered, and that by inſpiration from heauen. Betwixt theſe two, there are manie Arts full of ſecret and abſtruſe notions, deepe myſteries, and high contemplations, yet none me thinkes, that can ſtand in competition with this we haue in hand concerning the frame of Man. For to let paſſe the reſt; if it ſhall be obiected, That the infinite extent, the abſolute & circular figure, the perpetuall and rapid motions of the Heauens, the glorious bodies wherewith they are ſpangled, the ſweete harmony of their Spheares, the powerfull influences of euery Starre, the leaſt of which is ſaide to be eighteen times as big as the earth; as they are in heighth and magnitude, ſo they are in dignity farre aboue the nature of man. If for the earth it ſhall bee ſaide, that it is the rich matter and Matrixe, the great Mother and Nurſe of all creatures, the ſpouſe of heauen, in whoſe onely boſome (as in their proper center) all the influences of the heauenly bodies, doe concurre and vnite themſelues, leſſe ſubiect to alteration then heauen it ſelfe if we beleeue Aſtronomers, immooueable, and yet in perpetuall motion, by the continuall corruption and generation of things, alwayes conſuming, yet neuer diminiſhed. If a Commonwealths man ſhall preferre the Art of Policy, whereby not onely particular men, but Cities, kingdomes, Empires, yea and the whole world is kept in order which otherwiſe would run head-long to confuſion, which is an image of Gods gouernment, and the very Character of his adminiſtrati-

administration in punishing vice,& rewarding vertue:if I say,any man shal prefer the knowledge of any of these to the mystery of the humane Nature,I would haue him know; that there is nothing either in heauen or on earth, or in the administratiō of them both,not only on mans part,but which is more, on Gods also,that is not equalled,yea the diuine history giueth vs warrant to say,exceeded in the frame of man.For,wheras in the creation of the Heauens and the Earth, and the furnitures and armies of them both, the great Architect wrought them all by his thought, worde, and deede, all falling into one instant of time: when he was to make Man, he holds a Councell, *Come let vs make Man according vnto our owne Image*; summoning thereunto,not only himselfe and all his atributes,as his power,his wisedome, his iustice, his loue and mercy, if not to cast in some part, yet to lend some influence of their diuine Natures toward his creation,but also his Son and the blessed Spirit: as if Man were a kinde of production of the whole Deity, or as the Poet saith, *Magnum Iouis incrementum*; which I am the rather bolde to say,because the learned Apostle vsurpeth the very words of another Poet to the selfe-same purpose, αὐτοῦ γὰρ καὶ γένος ἐσμέν, wee are also of his off-spring; not that I conceiue (as some blasphemously haue done) that hee was made out of the very essence of God, but because the image of the diuine nature, is most liuely imprinted in his soule and in his body, and in the substance & qualities of them both. For the Soule, it carrieth a deepe stampe of diuinity in the simplicity, inuisibility, & immortality thereof: That it is incorporeall and diffusiue,quickning,sustaining,gouerning and moouing the whole body, and euery part thereof, euen as God supporteth and ruleth the whole world, being by a diffusiue nature,or rather infinite omni-presence,at all times, in euery place: That as the Deity is but one in essence, yet distinct in persons, according to the Relatiue qualities therein, which yet hath neither different matters, nor formes (as we say) but are all one and the same essence; so the soule of man is but one, yet that one, consisting of three essentiall and distinct Faculties or powers,intellectual,sensitiue,and vegetatiue; which yet make no difference in the substance thereof, that it should not bee one and an entire soule. Againe, in the intellectuall part or power, there are two essentiall attributes resembling their prototype or originall in God,to wit,Knowledge and Will. As for the qualities of the soule, they are either internall, or externall. The internall,carry the image of the Creator, as S. *Paul* interpreteth it,in heauenly wisedome, iustice,and sanctity; the externall, in maiesty, dominion, and soueraignty ouer the creatures; both which, the Poet hath excellently put together, where he speaketh of mans creation, after the rest of the creatures.

Genes. 1,23.

Virg. Eclog. 4.

Actes 17, 27. *Rhembam.*

Colos. 3,10.

Sanctius his Animal, mentisque capacius altæ
Deerat adhuc, & quod dominari in cetera posset,
Natus homo est.

Onids Metam.

A creature holyer then the rest, and better fram'd to holde
A soule infused from aboue was wanting yet; So borne
At length was Man, the rest in bands of awefull power to folde.

Audius. The body also,as far as it was possible,carieth the image of God, not in figure as *Audius* & his followers the *Anthropomorphites* haue sottishly dream't, hee being an infinite Ocean of essence,transcendent, and aboue all comprehension of nature or time: which himselfe expresseth to *Moses* in the future tense of the substantiue verbe, *Ero*; signifying thereby, the present and eternall subsistence of a subiect,without any prædicate as we say in Schooles; but because the admirable structure, and accomplished perfection of the body, carrieth in it a representation of all the most glorious and perfect workes of God, as being an Epitome or compend of the whole creation, by which he is rather signified then expressed. And hence it is, that man is called a *Microcosme* or little worlde, as in the following discourse will more at large appeare; to which with this short preamble as a Preface of Honour,wee referre the Reader.

CHAP.

The first Chapter.

The Excellency of Man is declared by his parts, Namely, the minde and the bodie, and first what is the dignity of the Soule.

IN the inauguration or Coronation of a Prince, there is nothing more ſtately or magnificent, then to haue his ſtile rehearſed by men of greateſt Nobility, euery one adding ſomewhat thereto, till the whole number of his Seigniories and Honors are heaped vpon him: if therefore, wee liſt to ſearch what and how magnificent haue been the acclamations of all ages, we ſhall finde in the Records of Antiquity, that man in whom the ſparkes of heauenly fire, & ſeeds of the diuine Nature are, (as appeareth both by the Maieſtie imprinted in his face, and by the frame of his body, which was made vpright and looking toward heauen) was of the wiſe and prudent Prieſts of the Egyptians, ſtyled a reuerend & admirable creature. That thrice-worthy *Mercury* cals him a *great Myracle, a Creature like the Creator, the Ambaſſador of the Gods*. *Pythagoras*, μέτρον ἁπάντων, *the Meaſure of all things*. *Plato* θαῦμα θαυμάτων, *the wonder of Wonders*. *Theophraſtus*, the *patterne of the whole vniuerſe*. ἀντίμιμον παράδειγμα. *Ariſtotle, A politicke creature framed for ſociety*. *Syneſius, the Horizon of Corporeal and Incorporeall things*. *Tully, a Diuine creature, full of reaſon and iudgement*. *Pliny the worlds Epitome, and Natures Darling*. Finally, all men with one conſent, call him μικρόκοσμον, or, *The little world*. For his body is, at it were, a Magazine or Store-houſe of all the vertues and efficacies of all bodies, and in his ſoule is the power and force of all liuing and ſenſible things. That ancient *Zoroaſter*, hauing long admired the ſingular workemanſhippe ſhining in the frame of man, at length cried out, Ὦ ἄνθρωπε, τολμηρὸν μὲν φύσεως ἄχαλμα. *O Man, the glory of Nature, euen in her cheefeſt ruffe and pride, and her Maiſter peece, when ſhe durſt contend with heauen it ſelfe*. *Abdolas* the Barbarian, beeing asked what hee thought was the moſt admirable thing in Nature, is reported to haue anſwered not Barbarouſly, but wiſely; *That it is onely Man who far ſurpaſſeth all admiration*, for that beeing the Image and reſemblance of the whole world, he can ſuddenly (*Proteus*-like) transform himſelfe into any particular thing. *Fauorinus* did acknowledge nothing great vpon earth, but Man.

Mans ſtile or titles.
Mercurius Triſmeg.
Pythagoras.
Plato.
Theophraſt.
Ariſtotle.
Syneſius.
Tully.
Pliny.
Μικρόκοσμος.
Why hee is called, *The little world.*
Zoroaſter.
Abdolas.
Fauorinus.

The Diuines call him *Omnem Creaturam, euery Creature*, becauſe he is in power (in a manner) *All things*; not for matter and ſubſtance, as *Empedocles* would haue it, but *Analogically* by participation or reception of the ſeuerall ſpecies or kinds of thinges. Others, call him, the Royall Temple and Image of God. For as in Coin the picture of *Cæſar*, ſo in Man the image of God is apparantly diſcerned. Others cal him, the End of all things (which in Nature is the firſt cauſe,) to whom all ſublunarie created Bodies and Spirites are obedient, yet he himſelfe ſubiect vnto none, vnleſſe peraduenture one man come vnder the lee and ſubiection of another. The Kingly Prophet *Dauid*, ful of heauenly inſpiration, deſciphereth the dignity of man on this manner; *Thou haſt made him little lower then the Angels, thou haſt crowned him with glory and honor, and giuen him dominion ouer the workes of thy hands*.

How man is all Creatures.
Empedocles
Pſal. 8.

Theſe are excellent, that I may not ſay diuine commendations, which man hath, partly from his ſoule, the moſt excellent of all formes, partly from his body, which is as it were the meaſure and exemplary patterne of all corporeall things. The ſoule indeede is ſo diuine, that raiſing and mounting it ſelfe ſometimes aboue all naturall formes, it comprehendeth by an admirable, abſolutely-free, and incompulſiue power, all incorporeall things

The ſignes of Mans honour referred partly to his ſoule, partly to his body.
The excellency of the ſoule

The Soule alone is continually created

seuered and diuided from all matter and substance. This Soule, if it could bee discerned with the eye, or but conceyued by the minde, how would it rauish vs and leade vs into an excessiue loue of it selfe? Onely this is created, not generated; and albeit (as the Philosophers speake) there be a subiect supponed in her production, yet it is not produced out of the power of that supponed matter, but rather absolueth and perfecteth the same.

It alone is indiuisible. Immateriall.

This onely is indiuisible, for all other Naturall formes receiue augmentation, diminution and diuision, together with their subiects; but the Soule of man *Is wholly in the whole, and wholly in euery particular part*. This onely is immateriall, heerein alone participating with the Matter, that it is capeable of all species or kindes, euen as the first Matter admitteth all impressions and formes; and yet the manner of reception is not alike in them both. For that first matter receiueth but particular and indiuiduall formes, and that without vnderstanding: in the Soule are imprinted the vniuersall formes of things, and it hath also vnderstanding to iudge of them.

How the reception of formes differs in the first matter, and in the soule.

The matter admitteth those particular formes materially, and withall obliterateth or blotteth out the contrary forme whereof it was before possessed: the soule of man receiues and entertaines the generall and vniuersall notions of things, free from all contagion or touch of Matter, not abolishing the contrary, or diuers formes whereof before it was possessed. This alone is incorporeall, immortall, ἀναλοίωτος or immutable. This may be called the receptacle, promptuary, or store-house of all the species or kinds of things.

The soule is the place of the species or formes. *Aristotle.*

Aristotle in his third Booke *De Anima*, calleth it *After a manner all things*, *Because* (saith he) *In an Organe of sence, the sensible species or Images of things are blotted out, and as it vvere drowned, but the Soule retaineth them*. The *Platonists* do range it in the midst, as hauing God aboue it, & the *Intelligences* or Angels: below it, all bodies and all qualities that so it might be partaker of them both. According to Diuines, it approacheth very neere to the Nature of Angels, by reason of her vnderstanding or intellectuall power, of her originall, eternity, image, apprehension and beatitude.

Plato.

The soule is in the middle degree of all things.

The Nature of the soule is Angellicall.

To conclude, there is in the soule of Man something Metaphysicall, transcendent aboue Nature, vnknowne to the ancient Philosophers, who groaped but in the darke, and were inwrapped in a mystie or clowdy veile of ignorance; and is reuealed onely to Christians, to whom the light of the Gospell hath shined. For in it is a liuely resemblance of the ineffable Trinity, represented by the three principall faculties; *Memorie*, *Vnderstanding*, and *Will*. But stay: Why should I presume to describe the essence of the Soule, seeing it partaketh of so much Diuinity? for of diuine things *Symonides* hath sayde well, We can onely say what they are not, not what they are: Why should I paine my selfe to open that shrine which *Nature* her selfe hath veyled and sealed vp from our sences, least it should bee prophaned therewith?

In the soule appeareth the Image of the Trinity. *Symonides.*

Hence it is, that *Hipocrates* calleth it φύσιν ἀφανέα, *The inaspectible or inuisible Nature*, which can no more be described by vs, then our eye is able to see it selfe. These thinges therefore belong to a higher contemplation, and require a more skilfull Workman to draw but the lines, or euen to shadow them out. Let vs content our selues to handle that that may be handled, or at least is subiect vnto some of our sences, and so proceede to the other part of Man, namely, the Bodie, which more truely and properlie is the subiect of our Discourse.

Hipocrates.

Of the Dignity and wonderfull frame of Mans Body.
CHAP. II.

The excellency of mans body is sette forth by foure things.

AS the soule of man is of all sublunary formes the most noble, so his Body, the house of the soule, doth so farre excell, as it may well be called μέτρον, the measure and rule of all other bodies. There be many things which set foorth the excellency of it, but these especially among others. The frame and composition which is vpright and mounting toward heauen, the moderate temper, the equal and iust proportion of the parts; and lastly, their wonderfull consent & mutuall concord as long as they are in subiection to the Law & rule of Nature: for so long in them we may behold the liuely Image of all this whole Vniuerse, which wee see with our eyes (as it were) shadowed in a Glasse, or desciphered in a Table.

1. An vpright frame.

And first for the Figure. Man onely is of an vpright frame and proportion, whereupon hee is called of some ὀρθρανοσκόπος, vsually ἄνθρωπος, as it were ἄνω θεωρῶν looking vpwards; although

Plato

Plato in *Cratylo* is of opinion, that man is called ἀνθρωπος, as it were ἀναθρωντα ἃ ὁπωπε, that is, contemplating those things which hee seeth. The reason of this forme or Figure, is meerely Philosophicall, as depending vpon the efficient, materiall, and finall causes. The efficient is two-folde, Primary and Secondary: The primary, is the soule, which comming from without, and being infused into the body from heauen, whilst she is building of her selfe a mansion fit for such functions and offices as shee hath to performe, as mindfull of her owne Originall, lifteth her building vp on high. The Secondary efficient of mans bodie is heate, wherewith man aboue other creatures aboundeth, especially the parts about his heart.

Plato in Cratylo

Of this vpright frame the efficient cause is two-fold. Primary. Secondary.

The Nature therefore of heate preuailing, forceth the increment or growth, vp from the middle part, according to his impetuous strength and nimble agility, that is, it striueth and driueth toward that part of the world, toward which heate is naturally mooued, that is to say, vpwards. For the matter of mans body, it is soft, pliable and temperate, readie to follow the Workeman in euery thing, and to euery purpose; for man is the moysteſt and most sanguine of all Creatures. The finall cause of the frame of mans body is manifolde. First, man had an vpright frame & proportion, that he might behold and meditate on heauenly things. And for this cause, *Anaxagoras* being asked wherefore he was born, he made answere, to behold the heauens and the Starres. Secondly, that the functions and offices of the outward sences, which are all placed as it were a guard in pension, in the pallace of the head, and in the view and presence Chamber of Reason, which is their soueraigne, might in a more excellent manner be exercised and put in practise: for they were not ordained onely to auoide that which is hurtfull, and to followe and prosecute that which is profitable; but moreouer also for contemplation: and therefore they were to be placed in the highest contabulation or Story of the body. And by this meanes, speech, which is the messenger of the minde, is the better heard from on high; the Smell doth more commodiously receyue and entertaine the vapor that ascendeth: the Eyes being as it were spies or Centinels, day and night to keepe watch for vs, & being beside giuen vs, that we should take view of those infinite Distances and glorious bodies in them, which are ouer our heads, did therefore require an vpright frame and composition of the body.

The material cause.

The finall cause three-fold. *First.* *Anaxagoras.* *Second.*

Finally, to conclude this point, man onely had an vpright frame of bodie, because hee alone amongst all Creatures had the Hand giuen him by God, an Organ or Instrument before all organs, and indeede in stead of all. Now, if the figure of man had been made with his face downward, that Diuine Creature should haue gone groueling vpon his handes, as well as vpon his feete, and those worthy and noble actions of his Hand, had been forfeited, or at least disparaged. For, who can write, ride, liue in a ciuill and sociable life, erect Altars vnto God, builde shippes for warre or trafficke, throwe all manner of Darts, and practise other infinite sorts of excellent Artes; eyther groueling with his face downward, or sprawling on his backe with his face vpward? Wherefore, onely man had the frame of his body erected vpward towards heauen.

Third.

For this cause also; onely man amongst all other creatures, was framed according to the fashion of the whole vniuerse, because he hath his parts distinct, the vpper, the neather, the fore, the backe parts, those on the right hand, and those on the left hand; the rest of the Creatures either haue them not at al, or very confused. The right parts and the left, are altogether alike, sauing that the left are the weaker, but the fore parts are very vnlike the back parts: the lower in some sort carrie a resemblance of the vpper. And so much of the figure.

Man alone framed according to the fashion of the whole world.

Man hath likewise a moderate temper, and is indeed the most temperate of all bodies, as being the μέτρον, measure, and rule of all others. The bodies of other Creatures, are either too Earthy, or too Watery: but to Mans, the temperature of all things liuing, both plants and Creatures is referred, as to the *Medium generis*, as we vse to say, that is, to the *middle of the vvhole kind*, so that they are sayde to bee hot, colde, moyst, and drie πρός τι, that is, according to reference, their temperature being compared with Mans. Againe, Man alone hath encluded in himselfe the temperature of all liuing things; all other creatures are in their seuerall kindes for the most part, of one and the same temper. But if you looke vnto mankinde, you shall finde manie that haue the stomacke of an Estrich; Others, that haue the heart of a Lyon; Some are of the temper of a Dogge, many of a Hog, and an infinite number of as dull and blockish a temper as an Asse.

The excellency of the bodie, is likewise set forth in the temperature. It is the middle of the whole kinde. Man alone hath in himselfe the temperature of al liuing things.

Moreouer, this also declareth the εὐκρασία or absolute temper of mans bodie, that it is subiect to many diseases, and is equally endamaged, as well by one extreme, as by another;

Why the body of Man was not made of an heauenly matter, but of an elementary.

becauſe it is equally diſtant from both extreames. There might indeede of the heauenly matter, being the moſt noble, haue beene made, a body moſt noble alſo; but it was of neceſsity it ſhould be made of ſublunarie and elementary matter, that it might bee capeable and apprehenſiue of the ſeuerall ſpecies and formes of things which mooue the ſences, becauſe from them all our knowledge is deriued. For man being borne to vnderſtand, & hee that vnderſtandeth, muſt apprehend thoſe viſions and fantaſies which are obiected eyther to the inward or outward ſence; and that there is no perception of any ſuch viſion or imagination, but by the miniſtry of the outwarde ſences, which are the intelligencers betweene the body and the ſoule; it was neceſſary that the body of man ſhould be compoſed of ſuch a matter as might bee capeable of theſe ſences; but of all ſences the foundation is *Touching*, which hath his eſſence and being in the temper and moderation of the four firſt qualities: whence it is, that the foure firſt ſubſtances wherein thoſe qualities do reſide, were neceſſarily to be the matter of the body, and thoſe are the foure Elements. And ſo much of the temperature of mans bodie.

3. the admirable proportiō of the parts.

Now the συμμετρία or due proportion, compoſition, or correſpondency of the parts of mans body, with reſpect each to other, and of them all to the whole, is admirable. This alone for a patterne do all workemen and Artſ-maiſters ſet before them: to this, as to *Polycletus* rule, do the Surueighers, Maiſter Carpenters and Maſons, referre all their plottes and proiects; they builde Temples, Houſes, Engines, ſhipping, forts, yea and the Arke of *Noah*, as it is recorded, was framed after the meaſure and proportion of mans body; for, as the body of a man is in length three hundred minutes, in bredth fifty, in heighth thirtie; ſo the length of the Arke was three hundred cubites, the bredth fifty, and the heighth thirtie. Moreouer, in this proportion of his parts, you ſhall finde both a circular figure, which is of all other the moſt perfect; and alſo a ſquare, which in the reſt of the creatures you ſhall not obſerue. For the Nauell being placed in the middle of the whole bodye, and as it were in the centre; if you lay a man vpon his back, and as much as may be labour to ſpred both his hands and feete, and keeping one end of the Compaſſe vnmooued and ſet vppon his nauill, doe turne about the other end, you ſhall come vnto both the thumbes, toes of the feete, and the middle finger of the handes: and if in any part this proportion fayle, you may immagine there is a defect in that part. Alſo, if you conceiue a meaſure betweene the feete ſpread abroad, and likewiſe betweene the hande and the foote on either ſide, you ſhal haue a perfect quadrate drawne and portrayed within a circle. And this is the true quadrature of the circle, not thoſe immaginary lines whereof *Archimedes* wrote, and which haue troubled the heades of all our Mathematicians for many ages, when as euerie one might haue found it in himſelfe. Theſe be excellent things which we haue obſerued, touching the figure and frame of mans body, the temperature thereof, and the proportion of the parts; but this laſt exceedeth all admiration, that in it ſelfe alone, it ſhould containe all whatſoeuer this whole world in his large and ſpacious boſome doth comprehend; ſo as it may worthily be called a Litle world, and the patterne and Epitome of the whole vniuerſe. The ancient Magitians (for ſo naturall Philoſophers were of olde tearmed,) as alſo the great wiſe Prieſts of the Egyptians, did make of this whole vniuerſe, three parts: the one, vppermoſt or ſuperiour, which they tearmed the intellectuall and Angelical part, the ſeate of the *Intelligentiæ*, (ſo they called the Spirits, which by tradition from the Hebrues, they vnderſtood were in the heauen) by whoſe direction and command, the inferiour or lower world is guided and gouerned: another middle, which they tearmed the heauenly part, in the middeſt whereof, the Sun ruleth, as the leader and moderater of the reſt of the Stars: the 3. ſublunary or Elementary, which is admirable & abundantly fertile, in procreating, increaſing and nouriſhing of creatures and plants. The Images and reſemblances of which three partes, who ſeeth not plainly expreſſed, and as it were portrayed out with a curious penſill in the body of man? The head, the Caſtle and tower of the ſoule, the ſeate of reaſon, the manſion houſe of wiſedome, the treaſury of memory, iudgement, and diſcourſe, wherein mankinde is moſt like to the Angels or intelligencies, obtaining the loftieſt and moſt eminent place in the body; doth it not elegantly reſemble that ſupreame and Angelicall part of the worlde? The middle and celeſtiall part, is in the breaſt or middle venter, moſt exactly, and euen to the life expreſſed. For as in that celeſtiall part, the Sun is predominant, by whoſe motion, beames, and light, all things haue their brightneſſe, luſter, and beauty; ſo in the middeſt of the cheſt, the heart reſideth, whoſe likeneſſe and proportion with the Sun, is ſuch and ſo great, as the ancient writers haue beene bolde to call the Sun,

The circular and ſquare figure appearing in Mans body.

Archimedes quadrature of the circle found in mans body.

4. Man containeth in him ſelfe al things in the whole world.

Three partes of the world.

The Collatiō of man with the world.

The elegant Analogie betweene the Sun and mans heart.

The hart of the world, and the heart the Sunne of mans bodie. For euen as by the perpetuall and continuall motion of the Sun, and by the quickning and liuely heat thereof, al things are cheered and made to flouriſh; the earth is decked and adorned, yea crowned with flowers, brings foorth great varietie of fruites, and yeelds out of her boſome innumerable kinds of Hearbes, the ſhrubs thruſt forth their buds or Iems, and are cloathed with greene leaues in token of iollity, all creatures are pricked forward with the goades and prouocations of luſte, and ſo ruſhing into venereall embracements, do ſtore and repleniſh with a large and abundant encreaſe, both Cities, Land, and Seas; (for which cauſe, *Ariſtotle* calleth this *Ariſtotle.* proſperous, refreſhing, and comfortable Starre γενεσιον, as beeing the procreator of all things,) and on the contrary, the ſame Starre of the Sunne, being departed farre from our Coaſts, the earth begins to be horrid and looke deformed, the ſhrubs are robbed and diſpoyled of their leaues, berries and verdure, and a great part of thoſe things, which the fertility of Nature had brought foorth, is weakened and waſted: ſo in like manner, by the perpetuall motion of the heart, and by the vitall heate thereof, this litle world is refreſhed, preſerued, and kept in vigor and good life: neither can any thing therein be either fruitfull, or fit and diſpoſed to bring foorth, vnleſſe that mighty and puiſſant power of the heart, do afſoord and yeelde an effectuall power of fœcundity. The Vital faculty floweth from the heart as from the fountaine, the Celeſtiall faculty from heauen. This latter, is ſaide to be the preſeruer of all inferiour things: the former kindleth, nouriſheth, and refreſheth the Naturall heate of euery part. The Heauen workes vpon the inferiour world by his motion and light; the Heart by his continual motion and æthereall ſpirit, as it were a bright light, cleareth and beautifieth all the parts of the body. The motion and light are in the ſuperiour bodies, the inſtruments of the intelligencies and of the heauens; of the intelligencies, as of the firſt mouers vnmooued, of the heauens, as of the firſt mooued mooued. The vital ſpirits and pulſation or beating of the heart, are inſtruments of the ſoule, and of the heart: Of the ſoule, as of a mooued not mooued; of the heart, as of a mooued mooued by the ſoule.

The excellēt ſimilitude of the vitall and celeſtial faculties.

Now further, who ſeeth not the ſublunary part of the world expreſſed in the inferiour venter or lower belly? for in it are contained the parts that are ordained for nouriſhment & procreation; ſo as we neede not make any doubt to profeſſe and affirme, that all things are found in the body of man, which this vniuerſall world doth embrace & comprehend. Wilt thou ſee in this *Microcoſme* or little world, the wandering Planets? The moyſt and watrie power of the Moone, is reſembled by the ſtreaming marrow and pith of the back & braine. The power of *Venus* is proportioned in the generatiue parts: To *Mercurie* ſo variable, and withall ſo ingenuous, the inſtruments of eloquence and ſweet deliuery are anſwereable. Of the Sun and the heart, the admirable proportion and agreement, we haue already declared. To the beneuolent and beneficiall Starre *Iupiter*, the Liuer of man, the well-ſpring of moſt ſweete and gratefull humors is fitly compared. The fire and fury of *Mars*, the little bladder of the gaul gathers into it ſelfe. The cold and harmfull Starre *Saturne*, that looſe and flaggy fleſh of the Spleene, being the receptacle of melancholike humors, dooth liuely reſemble. And thus in like numbers, and equall proportion, both Arithmeticall and Geometricall, do theſe Celeſtiall particles (as they are tearmed) of either worlde, the greater of heauen, and the leſſer of man, anſwere one another. The xii. ſignes of the Zodiake, by the Aſtrologers elegantly depictured in the body of a man, I paſſe ouer with ſilence: for theſe are thinges ancient and commonly knowne, as being ſung in the corners of our ſtreets: wee chooſe rather to meditate of more ſublime and profound matters, and to bend the eye of our minde at a higher marke. The *Peripatetikes* do diuide the world into bodies ſimple & mixt; ſimple, they make fiue, the heauen, and the foure Elements; of the mixt bodies, they will haue ſome to be imperfect, which they call Meteors, and thoſe Fiery, Aiery, Watry, Earthy: other ſome perfect, as thoſe things that haue life. All which, how and after what manner they be in man, becauſe it is an excellent and beautifull ſpeculation, I pray you marke and obſerue with me diligently. Of this little world, the ſimple bodies are fiue, the ſpirits and the foure humors. The Spirit is the quinteſſence or fift eſſence, æthereal, in proportion (as ſayth the Philoſopher) anſwering to the element of the ſtarres; the foure humors are called the foure ſenſible elements of the bodie. Choler in temper the moſt hot and raging, reſembles fire. Blood hot and moyſt, reſembles the ayre. Flegme cold & moyſt, reſembles the water. Melancholy, cold and dry, is fitly compared vnto earth. Behold alſo, the wonderfull Analogie of the Meteors of this little world. The terrible Lightning and fiery flaſhes and impreſsions, are ſhewed in the ruddie ſuffuſions of our eyes when we are in a heate and furie, as alſo by thoſe

The wandering Planets in the little world.

The compariſon of both worlds according vnto the doctrin of the *Peripatetikes.*

The ſimple bodies of Mā.

The Meteorologie of the litle world.

thoſe ἐυλάμπας or darting beames which we throw from the ſame. The rumbling of the guts, their croaking murmurs, their rapping eſcapes, and the hudled and redoubled belchings of the ſtomacke, do repreſent the faſhion and manner of all kindes of thunders. The violent and gathering rage of bluſtering windes, tempeſtuous ſtormes and guſtes, are not onely exhibited, but alſo foreſhewed by exhaled crudities, and by the hiſsing, ſinging, and ringing noiſes of the eares. The humor and moiſtneſſe that fals like a Current or ſtreame into the empty ſpaces of the throate, the throtle and the cheſt, reſembleth raine and ſhowers. Thicke and concocted Flegme, that comes vp round and roundly when we Cough, carries the likeneſſe of Haileſtones; teares do repreſent the Dew: ſhaking, ſhrinking, trembling, & throbbing motions, reſemble the Earth-quakes. There are alſo found in our bodies, Mines and quarries, out of which, Mettals and ſtones are digged, not to builde, but to pull downe the houſe; ſo the ſtones of the Kidneyes and bladder do carry a reſemblance of Mines and Mineralles.

This is the Meteorology of this Little worlde, this is the demonſtration of thoſe things therein that are imperfectly mixed. And if you require in man an example of a bodye perfectly mixed, behold and conſider the whole body; in which, there is that concord and agreement of the foure diſagreeing qualities, and ſo iuſt & equal a mixture of the elements, as that it is the very middle and meane amongſt all liuing and animated things. This Little World therefore, which we call Man, is a great miracle, and his frame and compoſition is more to be admired and wondered at, then the workemanſhip of the whole Vniuerſe. For, it is a farre eaſier thing to depaint out many things in a large and ſpacious Table, ſuch as is the world; then to comprehend all things in one ſo little and narrow, as is the compaſſe of mans body.

Epicurus, Momus, Plinie, and other the malicious and falſe detractors from Nature are cenſured, and the Excellency of Man is demonſtrated by his Nakedneſſe. Cap. III.

LEt that beaſtly *Epicure* now lay his hand vpon his mouth, & keepe ſilence, who was not aſhamed to affirme, that the bodies of men were made by chance and fortune, out of a turbulent concourſe (forſooth) of a number of Atomies or Motes, ſuch as we ſee in the Sunne. Let *Momus* be hiſſed and exploded, but firſt mark't with a blacke brand of ignorance and infamy, who preſumptuouſly blamed in the frame of mans body many things, as lame, maimed, and vnperfect. Let *Plinie* and all the whole rabble of falſe and counterfet Philoſophers, be baniſhed out of the Schoole of Nature, who ceaſe not to wrong and traduce her, for caſting foorth man naked and vnarmed on the bare ground vpon his Birth day, to begin the world with crying and lamentation. For to begin with the *Epicure*: Thoſe things which come by chance (O *Epicure*) happen but ſildome, and of ſuch thinges neither any certaine, nor any proſperous euent, can conſtantly be expected or hoped for: but if thou doeſt heedfully obſerue ten thouſand men, thou ſhalt finde all their bodies made and framed with equall skill and vnmatcheable Art, the ſame ſtructure of bones, cartelages, ligaments, ſinewes, veines, arteries, and enterals, the ſame context and compoſition, figure or faſhion, number and ſcituation: the right ſide like vnto the left, and all the body within one and the ſame circle and compaſſe equally poyſed; ſo that nothing in the frame of mans body, doth thruſt it ſelfe in by chance, nothing there is, that doth not exhibite and repreſent vnto vs the maieſty of the higheſt & moſt heauenly wiſedome.

The error of the Epicures conuinced.

Galen, to conuince the error of this beaſtly *Epicure* ſaide, Hee would giue him a hundred yeare to alter or change the ſcituation, figure, or compoſition of any one part, and hee did not doubt, but it would come to paſſe in the end, that he would be forced to confeſſe, that the ſame could by no meanes haue bin made after any other or more perfect manner. I will ſpeake ſomewhat more boldly; If all the Angels ſhould haue ſpent a thouſand yeares in the framing & making of man, they could not haue caſt him in ſo curious a mold; or made him like to that he is, much leſſe could they haue ſet him forth in any better maner. Let the *Epicure* therfore be packing with this falſe fiction & feigned inuention of his own addle brain.

Galen.

As for *Momus*, he is to be ſcorned for his dotage & ſimplicity, who wiſhed mens bodies had bin made ful of windowes; that the affections of the mind might haue appeared. Why *Momus*? Do not all the paſsions of the minde appeare plainly characterized in the face, in the countenance, & in the eyes, ſo that he which runnes may reade them? The eyes are the diſ-

The ſlander of *Momus* cõdemned.

couerers

couerers of the mind, as the countenance is the Image of the same; by the eyes as by a window, you may looke euen into the secret corners of the Soule: so that it was well sayde of *Alexander*, ὀφθαλμὸς τῆς ψυχῆς κατοπτρον εἶναι, that the eyes are the mirror or Looking-glasse of the Soule. The Eyes wonder at a thing, they loue it, they desire it; they are the bewrayers of loue, anger, rage, mercie, reuenge: in a worde; The eyes are fitted and composed to all the affections of the minde, expressing the very Image thereof in such a manner, as they may seeme to be euen another Soule; & therefore when we kisse the eyes, we seem to reach and diue euen to the verie soule. And for the face, how many signes are there in it, and those very manifest and apparant, of a sorrowing, fearing, couetous, wrathfull and pleasant minde? In the countenance, audaciousnesse, shamefastnesse, and Maiesty are euident and conspicuous. For in the eyebrowes dwelleth pride, in the cheekes shamefastnesse, in the chinne maiesty: all these are bred in the Heart, but heere they haue their seate and residence, hither they betake themselues, heereupon they depend. *Alexander.*

Their vnbrideled insolencie is also to bee restrained, that call Nature a cruell Steppemother, because shee casts foorth Man into the world altogether naked and vnarmed both in soule and bodie; and therefore holde him to bee of all Creatures the most imperfect. And of the Nakednesse of the Soule, thus they discourse. Other Creatures (say they,) do perceyue and vnderstand their owne Nature; some betake themselues to the swiftnesse of their feete, some trust to the loftinesse of their flight, some to swimme in the Waters; Man knoweth nothing, neyther how to speake, nor how to goe, nor how to feede: and in a word, that Creature which is borne to rule and gouerne all the rest, is enclined by Nature to nothing else but mourning and lamentation; beginning his life with punishment, and that onely for one fault, to wit, because he is borne. How vnjustly Nature is called a sowre step-dame to Man. The soule of Man naked.

Moreouer, many go beyond him (say they) in perfection of the sences. For, in the piercing sight of the eyes, the Eagle; in the quickneſse of smelling and sent the Dogge; in hearing, the Foxe and Mole are quicker then wee; in tasting, the Henne is sharper; in touching, the Spider is more exquisite then wee: and so the Soule of man is more imperfect then that of other creatures.

Let vs heare also the complaints they make of his body. Nature hath giuen other creatures diuers couerings, shelles, rindes, haire, bristles, feathers, scales, fleeces, hornes, teeth and nailes, whereby they are able both to defend themselues, and offend others; onely Man she hath prostituted in his very natiuitie, altogether vnarmed, naked, and vnable to helpe himselfe. They complaine also, that in bignesse of body we are not equall vnto the Elephants, in swiftnesse to the Harts, in lightnesse to the Birds, in strength and might vnto Bulles, in length of life to the Crowes: that the beasts of prey, haue a skinne more solide; the Doe more slicke and comely, the Beares a skinne thighter then ours; and to shut vp all, they say no creature hath a life more fraile and brittle then Man. But how ill they reason, & how vniust and vnequall valuers they be of the diuine blessings, let all men heare and vnderstand. Surely God euen for this purpose created Man naked, that hee might be the Prince and ruler of all those things, that are comprehended within, or subiected to the Law and dominion of *Nature*. For as the organes or instruments of the sences, are void of all strange and externall qualities, that they may receiue and entertaine the seuerall species and shapes of all other things; no particular colour in the Cristalline humour of the eyes, no naturall and inbred sound in the eare, the tongue not falsified with any taste or sauor, the nosethrils haue no proper or particular smell, touching is not possessed of any one extreame; right so it was not meet, that the minde or soule of man, which as the Philosopher teacheth, *Was in power in a manner all things*, should be adorned and taken vp with any particular Art and industrie. The bodye of Man naked. An elegant demonstratiō why the body is naked. *Aristotle.*

The body also behooued to be naked and vnarmed, that such a creature as was to gouern all the rest, should not be tied onely to one kinde of armor or weapon: and how incommodious and vnseemely had it bin for man, being made for contemplation, alwaies to haue borne armes? Now, he can at his owne will and pleasure, both girt himselfe in all manner of armour, and againe presently lay it aside: and therefore, man is naked, and so it beehooued him to be. But yet God hath not left him destitute euen in this kinde; hauing armed him with three seuerall muniments, which hee hath denyed to other liuing Creatures; Reason to inuent, Speech to call for assistance, and Hands to bring his will to acte and perfection. Reason, is the hand of the vnderstanding, Speech the hand of Reason, and the Hand it selfe, is the hand of Speech. Why the body is naked. God hath armed man with three defences.

The

The hand executeth thoſe things which are commanded, our commandements are ſubiect and obedient to reaſon, and reaſon it ſelfe, is the power, force, and efficacie of the vnderſtanding. So that in recompence of the nakedneſſe of the ſoule, he hath two helpes giuen him, Reaſon, which is an Art before all Arts; and Speech, the Ambaſſador or interpreter of the minde. For the nakedneſſe of the bodie, he hath the Hand, the great Organ before all Organes, the inſtrument of all inſtruments. By the power of Reaſon and of the Hand, albeit man be borne weake and naked, yet is he ſecured from all dumbe creatures; whereas all creatures whatſoeuer they be, that are borne and brought forth more firme, yea & more fierce too; howſoeuer they are able ſtoutly to endure the force and violence of the heauens, yet they cannot be ſecure and free from Man. See now and behold thou, whatſoeuer thou art, that art a traducer and ſlanderous detractor of Nature; how bounteous and liberall bequeſts and Legacies this Mother of ours hath beſtowed vpon vs; how farre more puiſſant creatures, by the aide of Reaſon and of our Hands, wee haue ſubdued and brought vnder the yoake; how farre ſwifter we haue ouertaken; neither is there any mortall thing that is not ſubiected vnder our will and obedience. So then we ſee, that Reaſon dooth more auaile man, then any naturall gift doth the dumbe creature; the volubility and readineſſe of the tongue and ſpeech, more then the lightneſſe and nimble vſe of the winges and Feathers; the induſtry of the hands, more then the impetuous force and violence of Bulles, or the teeth or hooues of wilde and rauenous beaſtes, becauſe they cannot redeeme or free themſelues from being oppreſſed by vs, or acquit themſelues from the ſoueraigntie of our authoritie.

How behouefull Reaſon & the Hand is to man, & what he performes by them.

What the Body of Man differeth from other Creatures, and what it hath proper and peculiar in the compoſition and frame thereof. Chap. IIII.

AND now, leaſt thoſe that are skilfull and learned, ſhould want any thing in our diſcourſe that belongeth to the dignity of Man, and his admirable and wonderfull frame and compoſition; let vs proceede vnto ſuch other things, as the diuine wiſedome, the Mother and Gouernor of all things hath vouchſafed only to man, and ſee in what and how much the body of man differeth from the reſt of the creatures. As in man & other creatures there is the ſame manner of life and nouriſhment, ſo the frame and ſtructure of the vitall & naturall organes or inſtruments is not vnlike in them both; but as for the ſences and power of motion, wherein the Nature of the Animality (you muſt giue leaue to a Philoſopher to vſe his owne tearmes) or liuelyhood conſiſteth, foraſmuch as in man they do attend vpon, and ſerue a more noble Forme, and are prepared to more diuine vſes, then for the auoiding of euill, and ſuch other obiects of the appetite; it was therefore requiſite, that they ſhould haue Organs framed and made with more curious and exquiſite workemanſhip. There are therefore in man, ouer and beſides thoſe things that are already handled, namely, his vpright figure, and his Hands, which no other creatures haue; there are I ſay, many things in the ſtructure and compoſition of the animall organes, proper and peculiar to man, which do yet more demonſtratiuely prooue, yea and expreſſe alſo the dignity of his bodie. For to run through all, from the head to the feet. Firſt, of al liuing creatures, only man hath a head made into a round and circular forme, as it were turned on a wheele, both that it might be the more capeable to receiue a greater quantity of braynes, and leſſe apt to be ouer-taken with danger either from without or within; as alſo, for the more eaſe in mooving and turning about; and laſtly, becauſe it was to be the manſion houſe of Reaſon, that is, the ſoule. Now we know, that the Soule was infuſed into vs from Heauen, which euen to our ſence is round and circular: ſeeing then her heauenly habitation is round before ſhee be infuſed, it was likewiſe requiſite, that her manſion heere below ſhould bee orbicular alſo; yet is the head of man not exquiſitely round as a Bowle is, but after a ſort ſomewhat long alſo, riſing vp in the two crownes, and on the ſides it becommeth depreſſed and flatted. Onely Man of all liuing creatures, hath for his bigneſſe, a braine very large and ſpacious, and alſo very moyſt and watery, the better to performe the varietie of the Animal functions and offices; for the Soule doth not execute hir offices without the helpe of the Spirits: the matter and the ſubſtance of the Spirits is blood, now plenty of blood is not conteyned, nor cannot be concluded within a little and ſmall body.

What there is in mans body, proper & peculiar to Man.

1. A round head

2. A large brain.

The

The face is saide also to bee proper vnto man alone, whereupon the Greekes call it προσωπον, by a name deriued from the thing it selfe, because προσωθεν ὁπωπε, it seeth and is seene a farre off; to other creatures *Nature* hath giuen onely a mouth or a beake: but in the face of man, courage, shamefastnesse, and maiesty, haue their abode, and therefore man alone is bashfull & shamefast. At the beholding of this face, all creatures are affrighted, because in it there shine foorth more beames of the diuine Nature, then in all the body besides. 3. Man onely hath a face.

Furthermore, this one thing is admirable therein, that whereas in our face and countenance there are ten particles, or not many moe, yet you shall not finde any two among many thousands of men, that haue their countenance in all parts alike, but there is some diuersity, both in the lines, and in the proportion.

Man alone hath his eyes enamelled with diuers colours, & that in great variety; whereas other Creatures (the horse excepted) are in their kinds alwayes alike; so shall you finde oxen to haue all blacke eyes, Sheepe watry, other creatures red. 4. Eyes of diuers colours.

The eyes of Man are distant one from the other but a very little space, in respect of our proportion of magnitude with other creatures, that so the spirits might bee the more nimble, and more speedily transmitted from one eye to another. 5. The distance of the eyes.

Man alone of all creatures (saith *Pliny*) hath his eyes vitiated and corrupted, yea, and somtimes one or both wanting; whereupon came the names or nick-names of *Strabo*, one that is squint-eyed or goggle-eyed, and *Paetus* for one that hath rouling eyes, or squinted vpward. 6. The depraua-tion of the eyes. *Plin. lib. 11. ca. 37.*

The haires of the eye-lids are in four-footed Beasts only on the vpper lid, in Birds on the neather; Man onely (the Estrich excepted) hath haires on both sides, both on the vpper and neather lid. 7. Hairs on both sides the eies.

The nose of a man is higher, and standeth further out then the rest of his face for decency and comelinesse; in other creatures it is not so, but is flatted with the scull. 8. A nose standing out.

Onely in man the eares are fixed and immooueable, and placed on either side in a right line with the eyes: only in Man (except it be Apes, which are neerest to the proportion of mans body) are those bones we call *Clauiculæ* or Cannell bones, which serue to establish the arme, that in the diuers and sudden motions thereof, it might not be dislocated. 9. Eares imoueable. Cãnell bones.

There is no creature but Man hath Dugges in the forepart of his body, the Elephants haue indeed two dugs or paps, but not in their breast. 10. Dugges.

Those parts which in Man are foremost, that is, on the forepart, as the breast, the belly, the wezon, &c. foure-footed Beasts haue them below next vnto the ground, and those that man hath on the hinder part, as the backe, the loynes, and the buttockes, Beasts haue them in their vpper part. 11 The diuersity of scituation of the parts.

Man of all creatures is couered with the fewest haires, vnlesse it be in his head, which as it is the moystest part of his body, so also it is the most replenished with haires. 12 Fewes haires.

Againe, in creatures that are couered with haires, those parts are most hairy that bend downward toward the ground, the rest are either smooth without haire, or not so full of them. On the contrary, Man is most hairy on the forepart, because haires were made for a couering; the prone or bending parts of Beasts, stand in need to be couered, yet the foreparts are indeede more noble, but they are cherished and in some sort couered by the bowing and bending of the body: But in Man by reason of his lofty and vpright frame & composition of bodye, the forepart is alike exposed to outward iniury as the hinder part, and therefore it was meete the more noble part should bee couered, and (as it were) defended with haires. 13 A difference in those parts that arecouered with hairs

Onely Man hath haires growing vnder the arme-holes, and about the priuie members. 14 Haire vnder the arm holes

Man alone growes hoarie haired, and bald-headed. 15 Man alone hoary hayred.

The legs or haunches of all foure-footed Beastes, are abundantly full of bones and sinnewes, but very scantie of flesh; on the contrary, Man hath almost no part of his bodie, more fleshy then his hips, legs, and thighes. 16 Hips, legs, & thighes full of flesh.

Four-footed beasts do bow both their fore-legs and their hinder legs contrary to man, for he bowes his armes backward, and his legs forward. 17 The manerof bowing of the parts vnlike to other creatures.

Man, when he is come to his full growth hath his vpper part lesser then his nether part; but before hee bee growne, his vpper part is the greater; so is it not with the rest of the creatures; and therefore his manner of going is not at all times alike, but at first in his infancy he creepes on all foure, afterwards by little and little hee raiseth vp himselfe, and at length

length goes vpon his two feete.

19 The diffrence of the bones. In other creatures there is no difference of the bones, but they doe all appeare perfect, euen from their beginning; but in Children the fore-part of the head is soft and tender, & long before it be hardned. And whereas all other creatures come toothed into the world, Man begins not to haue teeth till the seauenth month after his birth.

20 Man alone two footed. *Plato* derided by *Diogenes*. Furthermore, of all creatures (excepting birds) that liue vpon the land, Man alone is two-footed, which mooued *Plato* to define him, *Animal bipes implume*; which definition *Diogenes* worthily derided, when hee flung a Cocke whose feathers he had pluckt off, into the Schoole, and cried out, *Behold Platoes Man.*

21 Man alone goeth vpright. Onely Man by the straitnesse of his legges goes exactly vpright.

22 Man alone sitteth. Onely Man vseth to sit, both because he cannot stand long, as the brute beastes may, which haue foure feete, and besides do lye vsually to rest themselues, prostrate vppon the ground; for that two feet cannot long beare the weight of the whole body: as also because it is necessary for more noble and excellent vses, to wit, for the practising and exercising of Arts, and for contemplation.

23 Man alone hath a smooth and slick skin. Onely Man hath a skin polished, smooth, cleare, and very temperate; other creatures haue either a shelly or scaly skin, or altogether hairy, or els too soft, because Touching is the ground and foundation of all the fences; and therefore the more simple and pure the touching is, the clearer also and the purer is the sence, and the phantasmes or imaginations the more subtle: by meanes whereof, the operation of the soule, is so much the more lofty and profound. And for this cause, *Aristotle* in his second Booke *De Anima*, is of opinion, that the strength and vigor of the wit and vnderstanding, are to bee iudged of by the coursenesse or fineneſſe of the touch.

Aristotle.

How profitable and behouefull Anatomy is to the knowledge of Mans selfe. CHAP. V.

He that knowes himselfe, knowes all things. SEeing then that Man is a Litle world, and containes in himselfe the seeds of all those things which are contained in the most spacious and ample bosom of this whole Vniuerse, Starres, Meteors, Mettals, Minerals, Vegetables, Animals, and Spirits; whosoeuer dooth well know himselfe, knoweth all things, seeing in himselfe he hath the resemblances and representations of all things. First, he shall know God, because hee is fashioned and framed according to his Image, by reason whereof, hee is called among the Diuines, The Royall and Imperiall Temple of God; he shall know also the Angels, because hee hath vnderstanding as they haue; he shall know the brute Beasts, because he hath the faculties of sence and appetite common with them; he groweth as the plants do, hee hath being and existence as stones haue, and in a word, he is the rule and square of all bodies.

Plato in Alcibiade. Wisely therefore did the Oracle of *Apollo*, incite and stirre vp euery man to the knowledge of himselfe, as *Plato* hath it in his *Alcibiade*. This by the iudgement and consent of all men, is true and found Philosophy. For *Demonax* being asked, When he beganne to professe Philosophy, made answere, *When I began to know my selfe*. *Socrates* held it the next point to fury and madnesse, to enquire into high matters, and to search into strange and vncouth businesses, and bee ignorant in the meane while of those things that bee in our selues. This prepostorous skill was once very merrily and wittily by an old wife cast in the teeth of *Thales* the Philosopher of *Miletum*; who as he inconsiderately cast vp his eyes to behold the Heauens, fell into a pit; the old wife cried out, *Thou Foole, thou priest into matters that are aboue thee, & art ignorant of those things that are below thee, nay euen within thee.* Surely it was a worthy speech, and not beseeming an olde Beldame but a Philosopher. But this same knowledge of a mans selfe, as it is a very glorious thing, so it is also very hard and difficult. And yet by the dissection of the body, and by Anatomy, wee shall easily attaine vnto this knowledge. For seeing the soule of man being cast into this prison of the body, cannot discharge her offices and functions without a corporeall Organ or instrument of the body; whosoeuer will attaine vnto the knowledge of the soule, it is necessarie that hee know the frame and composition of the body.

How profitable it is to knowe our selues. *Demonax.* *Socrates.* *Thales.*

Anatomy the most sure guide to the knowledge of our selues.

After this manner, *Democritus* of *Abdera*, that he might finde out the seate of anger and melancholy, cut in peeces the bodies of beasts, and when he was taxed of the Citizens for madnesse in so doing, he was by the censure and determination of *Hippocrates*, adiudged to

Democritus

be

be very wise and prudent. Go too then, Is not he saide to know himselfe, who can tell how to temper and order the state and condition of his minde, howe to appease those ciuill tumults within himselfe, by the stormes and waues whereof he is pittifully tossed, and how to suppresse and appease those varieties of passions wherewith as it were with so manie furies he is vexed and tormented? But all this Anatomy doth verie plainly teach vs. For he that seeth and obserueth the whole body, which by the structure and putting together of sundry parts of diuers sorts and kinds, is (as it were) manifold & full of variety, to be made one by the continuation and ioyning of those parts; he that considereth the admirable sympathy of the parts, their mutuall consent and agreement, their common offices, or officiall administrations one for the helpe of another, how they make not any couetous reseruation to themselues, but do freely communicate each with other; such a man no doubt will so moderate and order the conditions and affections of his minde, as all things shal accord and ioyne in a mutuall agreement, and the inferiors shall obey the superiors, the passions obey the rule of right reason. He that shall diligently weigh and consider the vse of euery part, the fashion, scituation, and admirable workemanship of them all, as also, the Organs and Instruments of the outward sences, he shall easily perceiue how and after what manner he is to make vse of euery part; then which thing, what can be more excellent, what more profitable?

Anatomy teacheth how to order the state of the minde.

How to vse our sences.

Thou hast an vpright frame and posture of body, that remembring thy beginning, thou shouldst not like the brute beasts grouell vpon the ground, or dote vpon earthly things, but lift vp thy selfe towards heauen, and say with the Diuines, *Our conuersation is in Heauen.* Thy eyes are set in a high place, that thou mightst take notice; they are giuen thee to be aduanced to the contemplation of Heauenly things.

Why the eies are set in the top of the body.

Two eares, and those wide open, hath Nature ordained for thee; to teach thee that thou must heare, and by hearing, learne twice as much as thou must speake. Nature hath giuen thee but one tongue, tied with ten Muscles, and reyned with a very strong ligament, besides, as it were with a bridle, shut vp and enclosed within the mouth and teeth, as it were within a grate or Lattice, that the minde might first discerne and iudge of a thing before it vtter it, and that our words might first passe by the file, before they passe by the tongue. If you looke into the seats and residence of the faculties of the minde, you shall finde the rational faculty in the highest place, namely in the brain, compassed in on euery side with a scull; the faculty of anger, in the Heart; the faculty of lust or desire in the Liuer: & therefore we may gather these lower and inferiour faculties, must bee seruiceable and obedient to the higher, as to the Queene and Prince of them all. And if both Princes and Peasants would weigh and consider the mutuall offices betweene the principall and the ignoble parts, Princes might vnderstand how to rule, and Peasants how to obey. Princes may learne of the braine how to make Lawes, to gouerne their people; of the heart, how to preserue the life, health, and safety of their Citizens; of the Liuer, they may learn bounty and liberality. For the braine sitting in the highest place, as it were in a Tribunall, distributeth to euery Organ or Instrument of the sences, offices of dignity: the Heart like a King maintaineth and cherrisheth with his liuely and quickning heate, the life of all the partes: the Liuer the fountaine and well-spring of most beneficall humidity or iuice, nourisheth and feedeth the whole family of the bodie, and that at her owne proper costs and charges, like most a bountifull Prince. As for the meaner sorr of people, they may easilie vnderstand by the ministering and seruile organs, what bee the limits of seruice and subiection. For the parts that are in the lower bellie do all serue the Liuer; the Stomacke dooth concoct the meate, the Guts distribute and diuide it, the veines of the *Mesentarie* prepare it; the bladder of Gall, the Milt and the Reines, do purge and clense the princely Pallace, & thrust as it were out of the Kitchin, downe the sinke, all the filth and garbage. The parts that are included within the Chest, do serue the Heart; those that are in the head, do attend the Braine; and so each to others, doe affoord their mutuall seruices. And if any one of them do at any time faile of their duty, presently the whole Houshold gouernment goes to ruine and decay.

Why two eares.

Why but one tongne.

How much the knowledg of Anatomy auaileth kings and Princes.

The euidence of which truth, being by way of *Apologe* or Parable, seasonably represented to the people of Rome, *Menenius Agrippa* reuoked them, and laide as it were a Lawe vpon their furie, when they had gathered themselues into the Mount, (which afterwardes was thereupon called *Sacer*) hardly brooking the gouernment of the Senate. So that anatomy is as it were a most certaine and sure guide to the admirable and most excellent knowledge

of our ſelues, that is, of our owne proper nature. And therefore we reade, that valiant and couragious Princes, worthy and renowned Nobles, yea, and inuincible Emperors, being mooued and incited with this deſire of the knowledge of themſelues, did moſt ſtudiouſly practiſe this worke of Anatomy, euen in the noyſe and clattering of weapons and armour, and in the verie medly and tumult of warre.

What Kinges and Princes haue practiſed Anatomy.

Alexander the Great, among all the maine and great triumphes of his ſo excellent atchieuments, gloried that hee had diligently obſerued vnder his Maiſter *Ariſtotle*, the Nature and ſeuerall parts of liuing creatures. And it is found in the Records and Monuments of ancient Hiſtories, that the Kings of the Egyptians, did make diſſection of bodies with their owne hands. *Marcus Antonius* that great Commander, affirmed that he had learned his owne conſtitution by the diſſection of other bodies. We haue alſo read, that *Boetius* and *Paulus Sergius*, two *Romane* Conſuls, were Auditors of *Galen*, when he publikely practiſed this diſſection in the City of Rome. And ſo much ſhall ſuffice for the firſt profit and commodity that wee may reape by Anatomy.

Antonius.
Boetius.
Paul. Serg.

How profitable and helpefull Anatomy is to the knowledge of God. CHAP. VI.

How profitable Anatomy is to the knowledge of God.

IT is no doubt an excellent thing for a man to attaine to the knowledge of himſelfe, which thing Anatomy and diſſection of bodies doth teach vs, and as it were point out vnto vs with the finger; but there is another farre more Diuine and vſefull profit of Anatomy then the former, proper and peculiar to vs to whom the light of the Goſpell hath ſhined, namely the knowledge of the immortall God. That high Father and creator of all things, who onely by himſelfe hath immortality, dwelling in that light that is clearer then all lights, vnto which there is no acceſſe, whom no man can either ſee with his eyes, or comprehend with his minde, that eternall Father (I ſay) cannot be knowne but by his effects; and all the knowledge of God that can be had, muſt be deriued not *à priori*, but *à poſteriori*, not from any cauſe or matter preceding, but from the effects and thinges ſubſequent.

Moyſes. *Paul ad Rom.*

So we reade in the ſacred Scriptures, that *Moſes* could not endure the bright ſhyning face of God, his eyes were ſo dazled therewith. *The inuiſible things of God* (ſaith the Apoſtle) *are knowne by thoſe things that are viſible.* Who is it therefore, that will not honor, reuerence, and admire the author and workeman of ſo great a worke, if he do attentiuely aduiſe with himſelfe, how wonderfull the fabricke and ſtructure of mans body is? *I will praiſe thee, O Lord*, (ſaith that Kingly Prophet) *becauſe I am wonderfully made.* *Phidias* his *Minerua*, *Apelles* his *Venus*, *Polycletus* his Rule, are admired by antiquity; and therefore great and high honours haue beene decreed vnto them. *Cteſicles* is commended for making a marble Image with ſuch excellent art and cunning, that the *Samian* young men in deſire to obtaine the fame, were contented to lodge night by night in the Temple. And wilt not thou admire the arch-type and patterne of all theſe, I meane the body of Man? They did imitate in the workes of Nature, that which is of leaſt reſpect and regard, namely, the outward face and feature: for their workes are but dumbe, without motion or life. But by the view of Anatomicall diſſection, we ſee and are able to diſtinguiſh the variable and diuers motions of mans body, and thoſe alſo very ſtrange, and ſometime vncouth.

The frame of man is Gods Booke. *Heraclitus.*

Some of the ancient Writers, haue dignified the frame of mans body with the name & title of *The Booke of God.* For indeede, in all men there appeareth certaine ſparkes of a Naturall diuinity, or diuine nature; as *Heraclitus* witneſſeth, who ſitting in a Bakers ſhop, and perceiuing ſome of his Auditors which deſired to ſpeake with him, would not come vnto him into ſo homely a place, *Come in* (ſaith he) *for euen heere there be Gods* alſo. *Iouis omnia plena*, *All things* (ſaith the Poet) *are full of Iupiter.*

Gods admirable power ſhineth in the frame of man.

For euen in the ſmalleſt and moſt contemptible creature, there is matter enough of admiration; but yet in the frame of mans body, there is (I know not what) ſomething more diuine, as wherein appeareth not onely the admirable power of God, but his wiſedome euen paſt all beleefe, and his infinite and particular goodneſſe and bounty to Man.

For his power, it is not onely viſible but palpable alſo, in that of ſo ſmall a quantitie of ſeede, the parts whereof ſeeme to be all homogenie or of one kinde; and of a few droppes of blood, he hath framed ſo many and ſo diuers particles, aboue two hundred Bones, Cartilages yet more, many more Ligaments, a number of Membranes numberleſſe, the Pipes

or

Pipes or trunkes of the Arteries, millions of veines, sinnewes more then thirty paire, Muscles almost foure hundred; and to conclude, all the bowels and inward parts. His incredible wisedome appeareth in the admirable contabulation or composition of the whole, made of so many parts, so vnlike one to another. Enter thou whosoeuer thou art (though thou be an Atheist, and acknowledgest no God at all,) enter I beseech thee, into the Sacred Tower of *Pallas*, I meane the braine of Man, and behold and admire the pillars and arched Cloysters of that princely pallace, the huge greatnesse of that stately building, the Pedistals or Bases, the Porches & goodly frontispice, the 4. arched Chambers, the bright and cleare Mirrour, the Labyrinthæan Mazes and web of the small arteries, the admirable trainings of the Veines, the draining furrowes and watercourses, the liuing ebullitions and springings vp of the sinnewes, and the wonderfull fœcundity of that white marrow of the back, which the wiseman in the Book of the Preacher or *Ecclesiastes* calleth the Siluer cord. From the braine, turne the eye of thy minde to the gates of the Sun, and Windowes of the soule, I meane the eyes, and there behold the brightnesse of the glittering Cristall, the purity and neate cleannesse of the watery and glasy humors, the delicate and fine texture of the Tunicles, and the wonderfull and admirable volubility of the Muscles, in turning and rowling of the eyes. Marke and obserue also, the art and curious workmanship appearing in the inward part of the eare, how exquisitely it is made and trimmed with Labyrinths, windings, little windowes, a sounding Timpane or timbrill; three small bones, a stirrop, an anuile, and a hammer; the small Muscles, the Nerue or sinnew of hearing, and the Carteleginious or gristle passage, prepared for conueying all sounds vnto the sense. Looke vpon the vnweariable and agile motions, the conquering power, the frame and composition, the Muscles, the proper and peculiar kinde of flesh, the Membranes, the Veynes and sinnewes, and the bridle as it were, all easily distinguished within the compasse of that little body, or rather little member of the bodie, the Tongue, wherewith we blesse God, and wherewith we curse men.

The wisedom of God in the workmanship of the parts.

The elegant workmanship of the whole frame.

Consider and obserue the Heart, his two ventricles, eares as many, foure notable Vessels, which as *Hippocrates* sayth, are as it were πηγαὶ καὶ πλυγὰι φύσιος ἀνθρώπου, the fountaines and well-springes of the humane Nature, and the riuers and sourses whereby the whole body is watered and refreshed: besides eleauen gates or entrances; the admyrable and intricate Textures of the vessels of the Liuer, the separation and diuision of the currents of the Arteries and the Veynes; and in a word, consider the admirable structure of all the parts, Animall, Vitall, and Naturall; wilt thou not cry out, though it bee against thy will, O admirable Architect! O vnimitable workeman! And wilt thou not with the inspired Prophet sing vnto the Creator this Hymne, *I praise thee (O Lord) because thou hast shewed the greatnesse of thy wisedome in fashioning of my body*?

Hippocrates in his Booke of the Heart.

Lastly, the infinite goodnesse and bounty of God shineth in this excellent workemanship, inasmuch as he hath so well prouided for all the parts, that euery one hath her proper and peculiar vse, and yet all are so fitted and knit together in such an harmonie and agreement, that euery one is ready to helpe another; and any one of them being ill affected, the rest are immediatly drawne to a simpathy and participation with it. Which society and fellowship of the parts, *Hippocrates* in his Booke *de Alimento* hath thus breefelie, but excellently expressed, σύμπνοιά μία, συρροια μία, συμπαθέα πάντα: *One agreement, one confluence, all consenting*. To conclude then, these wonderfull and euer-worthy to bee admired workes of God in the composition and frame of mans bodie, are as it were dumbe Schoolemaisters, the Bookes of vulgar Diuinity, and the Doctors and teachers of Diuine wisedome.

Gods infinite goodnesse in the structure of the body.

How profitable Anatomy is to Philosophers, and in a manner to all Artificers and Handy-crafts men. CHAP. VII.

THese two fruites of Anatomy, as they are abundantly beneficiall and profitable, so they seeme to be common to all in general; first the knowledge of our owne Nature, and then of the inuisible God. There are also other benefites and commodities of Anatomy proper and peculiar to Poets, Painters, yea, and to the most part of handy-crafts men and Artificers, to teach them the better to bring their Arts to perfection. And first, *Galen* dooth account Anatomy verie proper to a naturall Philosopher, though it were but onely for speculation sake, or otherwise

Anatomy verie profitable for a naturall Philosopher.

wise to teach him the singular workemanship of Nature in euery particular part. For inasmuch as the proper and proportionable subiect of his art is a body Naturall, and the body of Man is as it were the square and rule of all other bodies, he ought not, nor cannot be truly accounted a Naturall Philosopher, who is ignorant of the historie of Mans body; and for this cause, that most excellent *Genius*, and interpreter of Nature *Aristotle*, wrote those elegant and eloquent Books of the History of the parts, and of the generation of liuing creatures. Anatomy is also very profitable for a morall Philosopher: for hee shall easily learne by the mutuall offices and duties of euery part, and by the constitution of the Naturall houshold gouernment appearing in our bodies, how to temper and order the manners and conditions of the minde, how to rule and gouern a Commonwealth or Citie, and how to direct a priuate house or family.

Aristotle.

Anatomie is profitable for a morall Philosopher.

I spare to speake how profitable it is for Poets and Painters, for the perfection of their Art and Science; for euen *Homer* himselfe hath written many things, and those verie excellent concerning Anatomy. But my purpose is onely to shew, that for a Physition, a naturall Philosopher, a Chirurgion, and an Apothecary, it is not onely profitable, but euen also absolutely necessary.

Profitable for Poets & painters. *Homer.*

Wherein is demonstrated that Anatomy is not onely profitable, but of absolute necesitie for Physitions and Chirurgions.
CHAP. VIII.

AS Geographie is worthily accounted a great euidence for the credite of an History, so to them that any way appertaine to the art of Physicke, the knowledge of mans body seemeth to be very necessary, φύσις γὰρ τοῦ σώματος ἀρχὴ τοῦ ἐν ἰατρικῇ λόγου. *For the Nature of the body is the first thing to be spoken of in the Art of Physicke.* Againe, *Hippocrates* in his Booke *de Flatibus*, maketh but one Idea of all diseases, *It is onely the variety & difference of places, that maketh the difference of diseases.* Hee therefore that will be ignorant of the Historie of the parts of Mans bodie, he shall ill distinguish and discerne the affections of the same, worse cure them, and worst of all foretell who are likely to recouer and escape, and who not.

Hip. de locis in homine.
Hip. de flatibus.

How necessary the knowledge of the parts is to the discerning of diseases.

The discerning and iudging of a disease, consisteth in two things, namely, the knowledge of the euil affect, & the knowledge of the part so affected. The signs of the part affected, are drawne and deriued from many Fountaines (as it were;) but especially from the scituation, and from the action empaired. For hee that knoweth the action of the stomacke to be concoction, if the concoction be empaired, he may easily discerne that the stomacke is ill affected. He that knoweth the Liuer to bee placed on the right side of the paunch, if the right *hypochondrium* or side be sore, or do swell, hee will presentlie affirme, that the Liuer and not the spleene is ill affected. Now this scituation, as also the actions of all the parts are taught and demonstrated vnto vs by anatomy onely.

Anatomy necessarie for *Prognosis* or prædiction. *Galen.*

For *Prognosis* or prediction of the euent of diseases, *Hippocrates* maketh three chiefe and maine heads of it: *Those things that are auoyded, the action impaired, and the habite of the body in the colour, figure, and magnitude or quantity*; all which are discerned onely by Anatomy. Now how much the knowledge of the seuerall parts of the bodie auayleth towardes the curing of diseases, *Galen* hath verie well expressed in the beginning of his Booke *de Ossibus*: πάντα (saith hee) ἐν τῇ ἰατρικῇ σκοπὸν ἔχει τὸ κατὰ φύσιν, that is, *All things that concerne the action of healing, haue that for their scope or direction which is naturally disposed, or in a good and lawdable constitution.* *Hippocrates* in his Booke *de officina Medici* giueth this rule, *That the Physition should first looke into those thinges that are alike one to another, and then to those things that are vnlike*: insinuating thereby, that he that knowes the perfect Sanitie or health of euery part, shall easily discerne if it fall from that perfection, by the perfection which remaineth in other like parts not tainted. *Aristotle* in his first Booke *de Anima*, vsurpeth a rule of Geometry, That which is straite and right (saith he) doth not onely measure it selfe, but bewrayeth that which is oblique or crooked. In like manner, how shal a Physition restore or set right bones that are broken or out of ioynt, if hee be ignorant of their naturall place, figure, and articulation? The exquisite method of healing cannot bee performed but by indications, and indications are not onely deriued from the disease, but also from the part affected, and the remedies must bee changed and altered, according to

Necessary for cutation. *Hippocrates*

the

the diuers and seuerall nature, temperature, scituation, connexion and sence of the part.

Neither is Anatomy needefull onely for the Physition, but euen also for the Chirurgion and Apothecary. The knowledge of the outward parts, as the Muscles, the nerues, the veines and arteries, is most necessary for a Chirurgion, for feare least in his dissections & launcings, he should mistake a broad Ligament for a Membrane, and a round Ligament for a Nerue or sinnew, least he should diuide an arterie in stead of a veine; for he that is ignorant of these things, shall euermore be in doubt; in things safe and secure still fearefull; and in things that are to be feared, he will be most secure and audacious.

Anatomy necessarie for a Chirurgion.

Anatomy profitable for an Apothecarie.

An Apothecarie also shall finde it very needfull for him to vnderstand the scite and figure of the parts, for the better applying of such remedies as shall bee requisite. For hee must apply his Topicall aud locall medicines, fomentations, oyntments or Liniments and Emplaisters, in their apt and proper places; as if the Liuer be ill affected, on the right side; if the Spleene be ill, on the left side; if the wombe or bladder be diseased, then vpon the *hypograstium* or water-course, betweene the nauell and the priuie parts; if the heart be ill affected, then on the left breast must the remedies bee applied. Hee must also make his plaister or other remedy of the same figure that the part affected is of, least the parts adioining be couered therewithall.

Profitable for the vnderstanding of the writings of the Ancients.

I forbeare to speake how profitable and necessary it is for the explaining of the writings of *Hippocrates*, *Galen*, and all the ancient Physitions. For in them there are many passages darke and obscure, whereunto the knowledge of Anatomy will giue a great light and splendor: and therefore in old time, Physitions were woont to propound vnto their young Schollers the precepts of Anatomy, as the first rudiments and principles of the art of Physicke and Chirurgery.

With what Method Anatomy may be best taught and demonstrated. CHAP. IX.

SEeing then, the profite and necesity of *Anatomy* is such and so great, I would perswade all Students, in our art especially, and in Chirurgerie, that they woulde very heedefully and diligently employ themselues in the studie of the same; neither shall they neede to be deterred or affrighted with the difficulty, for it is very easie and feasible, if it be laide downe in a good order and Method, otherwise the most easie and obuious art prooues harde and obscure. The Method therefore of learning and teaching *Anatomy* is on this manner.

Anatomy to be attained two wayes by Inspection & by Instructiō.

The Art of *Anatomy* (as I suppose) may bee attained two wayes; by Inspection, which we call ἀυτοψία, and by Instruction: and both these wayes are very necessary, if the perfection of the art be desired: but the first is the more certaine, the latter carrieth with it greater grace and state; the former may be called the way of Historie, or the historicall way; the latter, the way of Science, or the artificiall way. The first, which is Inspection, is either of figures depainted or carued, and printed on Tables onely, or of the bodies themselues of Men or Beastes; of Men, onely when they are dead; of beastes both dead and liuing, for the better obseruing of the diuers and obscure motions of the inward parts.

In like manner, the way of Doctrine or Science is double; One, by the writinges of most famous and renowned men; another, by the liuing voyce of a Teacher or Instructer.

Galen disallowed pictures of Plants and Anatomy.

The Inspection of Figures some haue disallowed, becausethey are bare shadowes, which in their opinion doe rather hinder then further young Students. For, if *Galen* would not haue Plants and Hearbes painted or desciphered, no nor so much as deseribed, but taught and deliuered by hand onely: how would hee haue endured the delineation of the parts of our body?

But I am not altogether of that opinion, to thinke these pictures vaine and ydle, becausse I see euerie day represented vnto mine eyes by these Pictures manie things,

The benefites of pictures.

and those oftentimes of great consequence, which were vnknowne to the skilfullest artists of former ages. Neyther do the Geometricians and Geographers, who are but the Anatomists of the Great world, as we are of the little; despise those demonstrations which in Cards & Maps they receiue one from another. Again, it is not alwaies, or in each place easie to find & obtain such store of humane carkasses, and therfore that want is well supplied by a curious draught or delineation of such obseruations, as are made in true dissections by cunning artists; that so both the memory of those that were present may be refricated and refreshed, and such as were absent, made also partakers of their labors; yet for all this, I do not thinke it fit to trust too much to these silent shadowes. For as it is not possible to make a good Commander, or a skilfull Pilot by any typicall or representatiue army, fortification, or water carde, but onely by practise and experience: so it is a very vaine thing to take in hand to learne Anatomy by the bare inspection of figures, without practise vpon the body it selfe: and because our art concerneth the cure not of Beastes but of Men, we must therefore exercise our selues chiefly in the anatomy of the bodie of Man, and that not aliue but dead.

Geometricians are Anatomistes of the Great World.

A Caution.

Comparison.

I am not ignorant that some of the ancient Physitians, as *Herophilus* and *Erasistratus*, by the License of Princes whom they had possessed with the profit thereof, did anatomize the bodies of condemned wretches euen whilst they were aliue, which also in our age hath beene done by *Carpus* and *Vesalius*. But for mine owne part, I hold it a very friuolous and vaine thing, beside the horror and inhumanity of the fact, which almost no necessitie can sufficiently warrant. For liuing dissections (as wee call them) are then put in vse, when we would finde out some action or vse of a part which by the dead carkas cannot bee discerned; now all those we may find aswel in Beasts as in Men. If it be obiected, that there is some difference betweene the actions of men and of beasts, especially the animall; and that the organ of voluntarie motion, to wit, the Muscles, are not alike in both kindes: I answer, that for the discerning of actions that belong to motion and sence, ther is no need of dissection, for they are almost all of them apparent to the sences; onely the motions of the hidden and secret parts, as not being subiected to sence, must be sought out by dissection. Now of those hidden motions, that of the heart and arteries, the midriffe, the brain, and the guts, which are of greatest consequence, are all one in men and in beasts; wherefore it is not anatomy but butchery, to mangle the trembling members of mans body, and vnder I know not what slender and idle pretence of profit, or behoofe, to violate the sacred Law of nature, and of religion.

Who vsed to butcher men aliue.

The cutting vp of men aliue is not only inhumane, but also of no profit or vse.

Obiection.

Answere.

The ancient Physitians were not allowd to cut vp dead carkasses of men, as we now vse dissection, but it was held a verie impious & prophane thing: how abhominable then is it, & sauoring of Caniball barbarisme, because we would make a nearer cut to our vnderstanding by our eyes then by the discourse and labor of our minds, to gather knowledge by the dissection or rather butchery of liuing men, if there were any vse of it, as we haue shewed that there is none. Let vs therfore content our selues, and giue due thanks vnto our State, by whose Lawes we are allowed dead bodies for dissection, euery yeare a competent number: and if there be any where want of such, wee may haue resort to the bodies of Beastes and make dissection of them both aliue and dead; aliue more sparingly, albeit by anatomy of liuing bodies, we may better discerne the actions of the parts, & by what Muscle euery part is mooued; in the dissection of dead bodies, the scituation, figure, magnitude, connexion, and originall of the parts, are well enough perceyued.

Those Beastes which come neerest to the frame of mans body, are fittest to bee dissected.

Five sortes of beasts according to *Galen*.

Now, because there are many kinds of Beasts, those are to be made choise of for dissection, which come neerest to mans body. *Galen* reduceth them to five sortes. The first sort is of such as chew the cud, that is, which after they haue eaten their meate, doe bring it againe from the dew-lap, as from a kinde of stomacke backe vnto the mouth, as Sheepe and Oxen. The second sort, is of those which diuide not the hoofe, as Asses, Horses, and Mules. The third sort, are such as haue teeth in manner of a Saw, as Lyons, Dogges, and Wolues. To the fourth sort, he referreth Hogges. To the fift, Apes. Now the dissection of all, or any of these, whether Man or Beast, is not to be taken in hand confusedly & disorderly, but methodically and with a due course of proceeding, and therefore it shall not be amisse, to prescribe some Lawes and Rules of Anatomy, for the better and more orderly practise and exercise of the same.

The method of Anatomy.

Lawes and rules of Anatomie.

This therefore, to begin withall, shall be the most generall and common rule, that wee begin with that which is best knowne, and that the dissection of dead bodies go before that

which

which is of liuing creatures, becauſe it is more eaſie and better knowne.

Againe, whereas ſome parts are externall and outward, others internal and inward: let young beginners firſt exerciſe their hands in the externall, foraſmuch as the knowledge of them is moſt eaſie and neceſſary for a Chirurgion.

Thirdly, whereas of the parts ſome are ſpermaticall and ſolid, as bones, griſtles, and ligaments; others fleſhy as the Muſcles: we muſt beginne with thoſe that are the proppes and ſupporters or vpholders of the reſt, as the bones, to which the Muſcles do cleaue, from which they ſpring and ariſe, and into which they are engrafted or inſerted. And indeede, before *Galens* time, the ancient Phyſitions in the Schoole of *Alexandria* did vſe to quarter bodies for their Schollers firſt, and afterward allow them whole carkaſſes. Againe, wee muſt know, that for the exquiſite diſcerning of the ſolid parts, the bodies of old and leane men are the fitteſt, becauſe they are not ſo fleſhy or ſo ouergrowne with fat; to which are anſwerable the bodies of ſuch as die of conſumptions.

The Schoole of Alexandria.

Fourthly, whereas there is a two-fold diſſection, either of a part taken from the whole, or of a part ioyning to the whole: the diſſection is firſt to be made of a part taken from the whole, becauſe it is more eaſie then to diſſect a part ioyning to the whole.

Fiftly, whereas in euery particular part *Galen* enioyneth three things to be obſerued & reſpected; the ſtructure, the action, and the vſe: the Anatomiſt muſt firſt ſearch out the ſtructure or compoſition, then the action, and laſtly the vſe.

Laſtly, in making diſſection, there is a two-fold order to be obſerued, the one where there is ſtore of dead bodies, the other where there is want and ſcarcity. If there be ſtore of bodies, you ſhall in one looke onely to the veſſels, in another to the Muſcles, in a third onely to the bowels or entrailes: but if you haue but one body and no more, and yet would ſee all in that, chooſe a bodie that is ſound and vntainted, and either hanged, ſmothered, or drowned; and in this body great skill muſt be vſed, that euery part may be ſhewed in his order and place. Now this order of anatomy is three-fold; of Dignity, of Scituation or diſſection, and of Preſeruation or continuance. The order of Dignity requireth, that we ſhold begin with the brain, as with the moſt noble part. The order of Scituatiõ or diſſection, requires that we ſhould firſt demonſtrate thoſe parts which firſt appeare in view to the beholders; and for Diuturnity, if we would keepe a body long, the diſſection muſt be begun at thoſe parts which are moſt ſubiect to corruption; & therfore, firſt cut vp the lower belly, then the Cheſt, after the Head, and laſtly the ioynts. This order all Anatomiſts do obſerue in Schooles, and in all publique diſſections, when as they deſire to ſhew all, or the moſt part, in one and the ſame body: and this is the firſt method or order of learning anatomy, namely, by inſpection, which is gained by diſſection.

The order of Anatomy threefolde.

Anatomy may alſo be taught without diſſection, and that either *viua voce*, by the liuing voice of the Teacher, or by writing. For there are many things which cannot be knowne by inſpection alone, which may notwithſtanding in good and apt words be taught, and ſo compaſſed; as namely, why the Muſcles are ſuch and ſo many, why of ſuch figure, magnitude, and the like: and for this cauſe, the Monuments and labours of olde and new Writers in this kinde, muſt be diligently trauailed in; whoſe names I intend to declare in the next Chapter. Now Anatomy may be deſcribed and ſo taught after a two-fold method. The one is called the way of ἀνάλυσις or reſolution, which reſolueth the whole into his parts; as when we diuide the body of Man into foure principall parts, the head, the cheſt, the belly, and the ioynts; and theſe againe we ſubdiuide and mince ſmaller and ſmaller, till we come to the moſt ſimple, vnmixt, and incompounded parts. The other is called γένεσις, or the way of compoſition, which of ſimilar parts maketh diſsimilar, and of theſe compoundeth the whole frame and ſtructure. But we eſteeme this laſt not to be the way of *Art*, but of *Nature*; and therefore leaue it to her who is onely able to performe it. The former belongeth vnto vs, as being the way of art, for we intend not to make a new man, but to preſerue and keepe a man already framed and made: and therefore as he that commeth to an olde yet ſtately pallace which he is not able to imitate, to repaire and amende the ſame, doth firſt take off the couerings, that ſo he may looke into euery corner, and ſee the defects of it, that he may apply himſelfe better to the reparation; ſo wee will firſt remoue the couer and ſhrine of this Sacred Pallace, and after looke as narrowly as wee can, into the ſecret corners of the ſame, that when we are called, we may bee better able to ſet our hands to the worke: and yet after we haue ended our whole Diſcourſe, we wil alſo giue you a view (as well as we may) of the worke of Nature, iterating the figures and their explicati-

How we may attain the skill of Anatomy by inſtruction

A two-folde Method of teaching Anatomy.

Analyſis.

Geneſis.

Compariſon.

plications which are diſperſed through the whole worke, but much more largely, according to the order of γένεσις or compoſition, that nothing may be wanting vnto you, which either our induſtry or charge may accompliſh for your behoofe; but firſt we will inſiſt in the order of diſſection.

Who haue written of Anatomy; and firſt what Hippocrates hath written thereof. CHAP. X.

The praiſe of *Hippocrates*.

Hippocrates of *Coos* was reuerenced by antiquity as the Oracle of *Greece*, or a kinde of Deity, rather to be adored then admired, much leſſe imitated. This Man, when the art of Phyſicke was yet rude and vnpoliſht, ſo laboured vpon it, that he left it ſmooth and terce: the knotted budde, by the ſtrength of his wit and vigorous rayes thereof, he made to ſpread into a glorious flower. He like a good Husbande, hath reduced the ſeedes of Phyſicke, diſperſed before in the large field of the world, into certain ſeed plots, whence we may fetch them one by one at our pleaſure: and truth to ſay, his writings reſemble ſeede moſt of all, for they are not great, but full of power and efficacie: for as a ſmall Acorne hath in it the power of a mighty Oake, ſo in him one ſhort Aphoriſme conſiſting of a few wordes, hath growne to fill whole volumes of Commentaries; and ſo all other his writings are very enigmaticall, hauing in them as many ſentences as wordes. Before *Hippocrates* time, the knowledge of Anatomy was very geaſon and ſcarſe: no writings of the ancients were extant of that ſubiect. He was the firſt Man, that being inſpired (as I verily thinke) with a diuine Spirit, & truſting (as well he might) to the ſtrength of the pinions of his owne wit, cut the firſt way through this abyſſe; not onely leauing encouragement vnto others, but alſo monuments of many things which pertained to anatomy. For I verily thinke, that that happie ſpirit of *Hippocrates*, was ignorant almoſt of nothing that doth neceſſarily appertaine to the vſe & practiſe of the art of Phyſick. For whereas *Galen* in his ſecond Booke *de Anatomicis Adminiſtrationibus*, maketh two ſorts of Anatomy; the one profitable, becauſe it is neceſſary for the practiſe of Phyſicke; the other, beyond the vſe of art, and more for ornament and pleaſure, then profit which hee calleth *Superabundant*: I preſume I can demonſtrate vnto you, that *Hippocrates* hath moſt exquiſitely and elegantly deſcribed that former profitable, and vſefull kinde of anatomy.

Hippocrates writings like to ſeed.

Galen.

Hippocrates not ignorant of that Anatomy which is vſefull and profitable.

Of parts ſome are Similar, ſome Diſsimilar; Similar, are the Bones, Cartilages, Ligaments, Membranes, Veines, Arteries, Nerues; and of all theſe *Hippocrates* hath written many things, and thoſe excellently well. Concerning the Bones firſt in generall, what is their Nature, their manner of generation, their materiall cauſe, their efficient, and finally their vſe, he hath excellently demonſtrated in his bookes *De Natura Oſsium*, *de Carnibus*, and *de Natura Pueri*. The matter he deſcribeth in theſe words; *When the fat exceedeth the glue, then are the bones framed.* The efficient cauſe hath he thus ſet downe, τὰ ὀστέα σκληρύνεται ὑπὸ τῆς θέρμης πεπυϊλωα, that is, *The bones being thickned by heate, are exiccated or dryed.* The common vſe of the bones, who did euer ſo accurately expreſſe in ſo fewe Wordes, τὰ ὀστέα τῷ σώματι ἐδάσιν καὶ ὀρθότητα καὶ εἶδος παρέχονται, that is, *The bones doe giue vnto the Body ſtability, vprightneſſe, and forme or faſhion*. Hee hath alſo deſcribed the particular hiſtory of the bones, their ſeuerall differences, their faſhions and their parts. Of the bones of the head, he writeth in his booke *de vulneribus Capitis*: of the reſt, in his Bookes *de Articulis*, and *de Oſsium Natura*. For before hee do deliuer the diſeaſes or affects incident to the bones, he inquireth into the nature and faſhion of euery Bone: a taſt of which his elegant order, I wil giue you in the deſcription of the backbone, whereby you may imagine how he hath done all the reſt.

How Hippo. deſcribed the Nature of bones.

Hip. deſcription of the backe bone.

The Nature of the Backe-bone (ſaith he) *is firſt to be knowne.* The figure of it is ὀυσυρόλιος that is, *In ſome ſort right and ſtraight*, but yet ſo, that ſometimes it bendeth outwarde, ſometimes inward. From the firſt backe-bone or *vertebra* of the necke to the ſeauenth, it hath *Figuram* λορδὴν, that is, *Inclining inward*, that it might bee ſubſtrated or couched vnder the Gullet, and the Rough Arterie. From the firſt Spondill of the backe vnto the twelfth, it hath *Figuram* κυφὴν, that is, *A forme bunching outward*, that the Organes of reſpiration might haue the better roome, and a more ſpacious cauity to extend themſelues in, to wit, the Heart and the Lungs.

The Loyns bend inward, & the *Os Sacrum* or Holy-bone, protuberateth or ſwelleth outward, yet with a ſtraitnes too, that ſo the cauity of the *hypogaſtriũ* or watercourſe might be

the

the larger, which was to containe the bladder, the right gut, and the wombe. The reſt of the bones he purſueth after the ſame manner.

Concerning the Cartilages, Ligaments, and Membranes, ſome things he hath deliuered heere and there, but ſcatteringly. Of the veynes he hath written many things, but all of them very obſcure, in his Booke *De locis in homine*, *De Morbo Sacro*, *De oſsium Natura*, and in the ſecond *Epidemiων*. And firſt, he doth very elegantly deſcribe the aſcendent and deſcendent trunke of the Hollow veyne, which he calleth κοίλη φλὲψ, that is, *the Liuer veine*; in the fourth ſection of the ſecond Booke *Epidem.* The Liuer veine (ſaith hee) paſſeth downward through the loynes, to the great or Holy bone. Againe, ariſing vpwards out of the Liuer, it aſcendeth through the Midriffe, and ſo runneth to the throate. As for the peculiar hiſtory of the veines, that is to ſay, the diuarication of their branches; albeit hee hath not preciſely ſet them downe, yet it ſeemeth he was not ignorant of them, ſo far as was needefull for the practiſe of Phyſicke: for hee mentioneth all thoſe branches which Phyſitians vſe to diuide in Phlebotomy; as for example, the veynes of the forehead, the nowle or backe part of the head called *Vena puppis* and we may call it the Sterne veine, the veines of the tongue, the eares, the iugular or throate veynes, the ſhoulder veyne called *humeraria*, the Liuer veine called *Baſilica*, that of the ham called *vena poplitis*, and the ankle veines called *Malleoli*. In the 68. Aphoriſme of the firſt Section, *When the backe part of the head is pained, the right veine of the forehead being opened, giueth eaſe.*

The deſcription of the hollow veine, after *Hippoc.*

Hippocrates knew all the veynes which are vſually opened.

Inſtances in them all.

In his third Book *De Morbis* in the *Angina* or ſquinancy, he ſtriketh the veynes vnder the tongue. In his Booke *de Aëre, locis & aquis*, he mentioneth the veynes behind the eares, which the Scythians did vſe to open, to helpe the Scyatica or hip-gowt. The Iugular veynes, he deſcribeth in the fourth Booke *de Morbis*. In his Booke *de Natura oſsium*, hee commandeth to open the veynes of the hams and ankles, in pains of the Loynes and Teſticles. In the firſt Section of the 6. Book *Epidemion* in fits of the ſtone, or inflāmations of the Kidneyes, hee openeth the Ham veynes. The ſhoulder veyne he deſcribeth in his Booke *de oſsium Natura*, calling it *ſanguiflua* or the blood-flowing veine. In his Booke *de victus ratione in morbis acutis*, in the Pluriſie he openeth the *Baſilica* or Liuer veine, which he calleth τὴν ἔσω φλέβα, that is the *inner or internall veine*. Now the common Originall and vſe of the veines, he declareth in his Booke *de Alimento*, as alſo of the arteries, ἐιζωσις φλεβῶν ἥπαρ, ἐιζωσις ἀρτηριῶν καρδίη, that is, the radication or roote of the veynes is the Liuer, of the Arteries the Heart: out of theſe, blood, ſpirits, and heate are diſtributed into the whole body. Of the Nerues you ſhall reade many things, yet diſperſedly: but for their cōmon Originall (which all men were ignorant of) he pointed it out manifeſtlie. All men almoſt do hold, that the ſofteſt nerues or nerues of ſenſe doe ariſe from the brain, the hard & ſuch as ſerue for motion from the *Cerebellum* or little braine: but now it is reſolued eſpecially ſince *Varolius* his curious ſearch by a new manner of anatomizing the head, that all the Nerues euen the *Opticks* themſelues, doe ariſe from this *Cerebellum* or backeward braine, which me thinkes *Hippocrates* inſinuateth in his Booke, *De oſsium Natura*. Νεῦρων ἔκφυσις, (ſaith he) ἀπὸ τοῦ ἰνίου ἄρχει παρὰ ῥάχιν ἐοῦσι, The originall of the Nerues, is from the *Occipitium* or hinder part of the head, euen to the racke bones, the hippes, the priuities, the thighes, the armes, the legges, and the feete. Of *Glandules* or Kernels hee wrote an entire Booke: and ſo much of the ſimilar parts.

Hippo. diſcouered the Original of the Nerues.

Varolius commendation.

Of the Organicall parts alſo he wrote much, and that excellently. Of the Heart a Golden booke, wherein he ſo excelleth, that I thinke neither *Galen* nor *Veſalius* haue gone beyond him for exact deſcription; but in it there are many things obſcure, which needes an Interpreter, if the world were ſo happy. The hiſtory of the infant, the Principles of generation, the conceyuing, forming, noriſhment, life, motion and birth, hath he moſt excellentlie deſcribed in his bookes *De Natura pueri*, *De ſeptimeſtri*, and *De octimeſtri partu*. We conclude therefore, that *Hippocrates* wrote very diuinely of Anatomy, but withall ſo obſcurely, as his workes euen to this age, ſeeme to be ſealed from the greateſt wits. I think therefore that he ſhall merit moſt of Phyſicke, who hauing all his furniture about him, ſhall labour to make manifeſt to the world, thoſe diuine Oracles, which hitherto we haue rather admired then vnderſtoode.

Hippocrates Golden booke of the Heart.

An exhortation to take paines in *Hippocrates*.

of

What Galen hath written of Anatomie, and how vniuſtly he is accuſed by the later writers eſpecially by Veſalius. CHAP. XI.

The prayſe of Galen.

ALmoſt all the *Grecians*, *Arabians*, and *Latines*, do very much extoll *Galen*, as after *Hippocrates*, the ſecond Father of Phyſicke; foraſmuch as he hath in ſuch ſort amplified and adorned the whole Art by his deep and diuine writings, that vnder him it may ſeeme to be as it were, borne anew. For indeede howbeit there were extant before many excellent Monuments & Records, yet were they ſo confuſed and ſhuffled out of order, that it ſeemed a new worke to gather together thoſe thinges that were diſperſed, to illuſtrate that which was hard and difficile, rude and vnpoliſht; to diſtinguiſh and order that which was confuſed, beſide many things which he obſerued in his owne particular experience. For other parts of Phyſick I will ſay nothing, but for Anatomy I will confidently auouch, that *Galen* hath ſo beautified and accompliſhed it, that he hath not onely diſperſed the blacke clowds of ignorance which hung ouer the former ages, but alſo giuen great light & ſplendor to the inſuing poſterity. For whereas there are three meanes, which leade vs as it were by the hand to the perfect and exact knowledge of Anatomy, namely, Diſſection of the parts, their actions, and their vſes: he hath ſo accurately deſcribed them all, as he hath gotten the prize from all men, not onely before him, but euen after him alſo. The manner of Diſſection, he hath manifeſted in his Bookes, *de Anatomicis adminiſtrationibus*, *de Diſſectione muſculorum & neruorum*.

Three things acompliſhing an Anatomiſt

The actions of the ſeuerall parts, he hath elegantly deſcribed to the life in his Booke *de naturalibus facultatibus* & *de placitis Hippocratis & Platonis*. But aboue all, are thoſe ſeuenteene golden bookes of the *Vſe of parts*, which are truly called Diuine labours, and hymnes ſung in praiſe of the Creator. So that the benefites we all, and thoſe before vs haue receyued by *Galen*, are indeede very great: and yet (the more the pitty) almoſt all the new Writers, do continually carpe and barke at him, yea teare and rend him, whether it be by right or wrong, wounding and lancing his credite vpon euery ſlight occaſion: one by way of cauill, another ambitiouſly ſeeking to make himſelfe eſteemed by *Galens* diſgrace, and few with any deſire that truth ſhould take place. But as flouds beating againſt the rockes, by how much they ruſh with greater violence, by ſo much they are more broken and driuen backe into the maine; ſo, & ſuch are their bootleſſe and ridiculous endeauors, who enterprize by the diſgrace of another, eſpecially of their Maiſters and Teachers, to gaine reputation vnto themſelues.

The ſlander of the new Writers againſt *Galen*.

But let vs ſee wherein theſe Nouices do blame *Galen*. Firſt they ſay, hee hath giuen vs onely the Anatomy of bruite beaſts, and not of Man, hauing neuer diſſected a mans body. Againe they vrge, that he was ignorant of many things, which at this day are generally & commonly knowne. Thirdly they ſay, he deliuers many things repugnant and contrary to himſelf. Laſtly, that he hath written all things confuſedly, & without Method or order. For (ſay they) what Method can ther be obſerued in his books of the *vſe of Parts*, which you cal diuine? Firſt he treats of the hand, then of the legges and feete, and laſt of all of the lower belly, and the naturall parts. How fillie theſe calumniations are, and how miſerably theſe men are by their owne ignorance deceiued, let all men heare and iudge. For to begin with the firſt, I ſay and affirme, that *Galen* did not onely cut vp the bodies of Apes, but manie times alſo the carkaſſes of men. My witneſſe ſhall be the author himſelfe. In his thirteenth booke *de vſu partium*, *I am determined* (ſaith he) *to ſet foorth the ſtructure and compoſition of Man alone*. In his firſt booke, *de Anatomicis adminiſtrationibus*, *It is meete to obſerue and looke into euery particle, eſpecially in men*. In the ſecond Booke, *Now* (ſaith hee) *the foote of an Ape differeth from the foote of a Man, in that the ſtructure of the fingers is not alike in them both*. In his fourth book *de Anat. adminiſt.* and in the third *de vſu partium*, he ſheweth the difference of the tendons which go to the legs and feete: and in his firſt booke *de Anat. Adminiſt.* he ſaith, that *The head of the Thigh is more crooked in men then in Apes, and the Muſcles alſo vnlike, which are inſerted into the legge*. He ſheweth alſo the diſsimilitude between the Loynes of a Man and an ape. In his ſecond booke *de ratione victus*, hee ſaith, that *A Man differeth from ſome creatures in the Originall of the Veyne called Azygos*, that is, the *ſolitary veine, or without a peere*. In the 13. booke *de vſu partium*, he ſaith, *That the wombe of a woman, differeth much from that of other Creatures*.

The confutation of the firſt ſlander.

So

So then, if *Galen* did ſo well vnderſtand wherein the bodies of Men and Apes did agree, & wherin they did diſagree, it is very likely that he had made diſſection of mens bodies: for in things which are ſo like, it is the part onely of an artiſt and expert practitioner, to know and diſcerne what is differing and vnlike. And ſo much for ſatisfaction to the firſt imputation which is iniuriouſly caſt vpon *Galen* by his ſlanderous detractors. They ſay farther, that *Galen* was ignorant of many things which appertaine to the ſtructure and compoſition of mans body; as if it were not proper to Man to be ignorant. Was not *Veſalius* ignorant of a number of things which were afterward obſerued and ſeene into by *Fallopius*? & do not we daily finde out many things whereof the former ages were vtterly ignorant? I appeale to that of the ancient Poet, οὐκ ἐις ἀνὴρ ὁ πάνθ' ὁρᾷ *One man ſeeth not all things.* The confutation of the ſecond ſlander.

And whereas they obiect, that *Galen* doth not agree with himſelfe, but writeth manie things repugnant and quite contrary, let them learne and bee aduertiſed, that it was the manner of the ancients, to deliuer many things diuers times according to the opinion of other men: and the interpreters beare record, that *Hippocrates*, *Ariſtotle*, and *Plato*, did many times ſpeake after the manner of the common people. So *Galen* ſpeaking according to the opinion of others, may haply write ſome things that doe not ſo well agree together: but when he diſputeth preciſely of the point of Anatomy, then he alwayes agreeeth and accordeth with himſelfe. A Cuſtome of the Ancients. *Galen* himſelf euer agreeth with himſelfe

Laſtly, they clamor that his Books *De vſu partium*, are written confuſedly, and vvithout Method: but their heate and furie of gainſaying, tranſports them I know not whither: for the Method of theſe Bookes is admirable, which being to many heeretofore vnknowne, I will now make plaine and bring to light.

I am determined (ſaith *Galen*) *to declare the ſtructure and compoſition of Man, and the vſe of all his particular parts*; and therefore what he hath proper and peculiar therein, & wherein he differeth from other Creatures, muſt firſt be opened. The wonderfull Method of the Books of *Galen de vſu partium.*

Firſt therefore, for the nakedneſſe of his ſoule, he hath Reaſon, which is an art before all arts, and in recompence of the nakedneſſe of his body, hee hath the Hand, an organe before all organes. Of the Hand therefore which Man alone hath, and no other Creature beſide, he diſputeth in his firſt and ſecond Bookes, ſo accurately and elegantly, that he hath preuented all men for getting any honour by treating of that ſubiect. And, becauſe the legges haue a great affinity with the hands, and that there is ſomething proper and peculiar in the frame and ſtructure of the ſame, (for onely Man by the benefit of his Legges, goes directly vpright) therefore in his third Booke he intreateth of the Legges; for ſo the order of teaching ſeemeth to require, that thoſe things which are alike, ſhould be deliuered together.

Hauing declared what things they are which are proper to Man onely, hee commeth then to ſuch as are common vnto Man with other creatures. And whereas of thoſe parts whereof the bodies as well of men as of other perfect creatures are compoſed, ſome doe preſerue and maintaine either a particular and indiuiduall creature, or the generall ſpecies or kind; others do ſeruice, & adminiſter vnto the former, as the veyns, arteries, and nerues: in the firſt place, he diſputeth of thoſe that conſerue the *indiuidium* or partciular creature: and theſe are either naturall, or vitall, or animall; by reaſon whereof, the body is diuided into three Regions. Of the Naturall parts, hee diſputeth in the fourth and fift Bookes; of the Vitall in the ſixt and ſeauenth: of the Animall, to wit, the Brain, in the eight & ninth: of thoſe things which depend vpon the braine, that is, of the Inſtruments or organs of the ſences, in the tenth, eleuenth, twelfth, and thirteenth bookes; which may bee called the order of Nature. The organes ordained for generation or propagation of the ſpecies or kindes, aſwel in men as women, are deſcribed in the fourteenth and fifteenth books. Thoſe parts that are ſeruiceable to all theſe, as the veines, arteries, and the nerues, are delineated in the ſixteenth. The ſeauenteenth which is the laſt, ſerueth as an Epilogue or concluſion to all the reſt: and therefore, theſe ſlanderous accuſers of ſo worthy a Writer, are no better worth, then to be ſent packing from all ſociety of ingenuous learned men.

How farre Aristotles skill stretched in Anatomy. CHAP. XII.

The praise of *Aristotle.*

ARistotle is intituled by all Philosophers, the true interpreter of Nature, the light, the *Genius*, the only spirit of truth, who is able not only to stir vp & awaken mens minds, but to fulfil & satisfie them. In a word, he is another nature, furnished with eloquence. For he hath very curiously determined of all natural things, and their causes; but that so darkely and obscurely, that he is vnderstood but by few; for he was vnwilling to blab abroad, and prophane the Mysteries of Philosophie amongst the rude multitude; and therefore he hid them, not vnder a veyle of Fables, as the ancient Poets; nor vnder a superstitious proportion of numbers, as the *Pythagoreans*, but wrapped them vp in obscure breuitie; so sending them abroad, as if he had kept them at home. So the Cuttle-fish to deceyue the Fishermen, powreth forth a blacke humor, and in that clowd she escapeth. And whereas there are two parts of naturall Philosophy; the first concerning the generall and vniuersall nature of things, the latter which searcheth out the particular nature of man, and all liuing creatures. In the first, *Aristotle* was so absolutely excellent, as no man, no, nor anie age of men may stand in competition with him; but in the second, how many things hee knew not, how absurdly he vnderstood diuers things hee knew, *Galen* and all the whole Schoole of Physitians haue prooued by demonstrations, but especially by αὐτοψία, or the sight of the eye, which is of all arguments the most demonstratiue. He writ Bookes of the Generation, of the parts, and of the Historie of the creatures, but he bequeathed vs many things out of the testaments of other men: neither is it likely, that hee did euer cut vp the body of a man; for if he had, hee would not haue so fowly erred in that which is obuious to the sence. For both in the Historie of the similar parts, and in the description of the dissimilar, he hath set downe many things very grosse and absurd: as in that, where he writeth, that the Veines do originally proceede from the Heart, which also hee maketh the wel-spring of the Nerues; where he saith there are three ventricles in the Heart, that the Braine was made onely to refrigerate or coole the heart, and such like many more, which we shall meete withall in our Treatings of the bones, the veynes, the arteries, the nerues, the heart, the braine, and other particular parts; and therefore in those places, the diligent and studious Reader may looke for, and finde them.

Aristotle was ignorant in the particular Historie of the creature, and in Dissection.

What the other Greeke Authors haue written of Anatomy. CHAP. XIII.

THere were after *Hippocrates* time, certaine famous men, that did diligentlie practise the art of Anatomy, and deliuered many things in writing, which haue all perished, I know not by what mishap, or destiny, whether I should call it. *Alcmæus Crotoniata* (as *Calchidius* reporteth,) did vse to anatomize mens bodies. *Diocles Carystius* in his Epistle to King *Antigonus*, diuideth the bodie of Man into the head, the chest, the belly, and the bladder. *Lycus Macedo* was accounted cunning in the Dissection of the Muscles; and his bookes (as saith *Galen* in his 4. booke *de Anat. Administ.*) were with great commendation dispersed all abroad. *Quintus*, *Lycus* his Schoolemaister wrote some things of Anatomy; *Marinus* published 20. bookes of those thinges which *Lycus* was ignorant of in Anatomy. *Erasistratus* did much in this kinde also. *Herophilus* (as *Tertullian* saith) cut vppe aboue seuenty bodies, and oftentimes the bodies of liuing men: of him *Galen* writeth thus. *Herophilus* aswell in all other things that appertaine to out art, as also in Anatomy, did attaine to a most exacte and exquisite skill and knowledge, and for the most part made his experiments not in bruite beastes, as most men vse to do, but euen in the bodies of men.

Alcmæus. *Diocles.* *Lycus.* *Galen.* *Quintus.* *Marinus.* *Erasistratus.* *Herophilus.* *Pelops,* *Galens* Schoolmaster *Diog. Apollon.* *Asclepiades.* *Eudemus.* *Praxagoras.* *Philotimus.* *Elianus.* *Polybius.* *Calistus.*

Pelops did publickly teach Anatomy, and was the Schoolemaister of *Galen*, he affirmed, that all the vessels of the body, did originally arise from the Braine. *Diogenes Apollonata*, wrote a Booke of Veynes. *Asclepiades*, *Eudemus*, *Praxagoras*, *Philotimus*, *Elianus*, *Polybius*, *Calistus*, in their seuerall times, did all of them excell in this art. Yet none of their writings remaine with vs; but if we beleeue *Aristotle* and *Galen*, they had many foolish and ridiculous conceites. There haue beene also Greekes of later times, who haue done somewhat

in

in Anatomy, as *Aretæus*, *Theophilus*, *Oribasius*; but *Galen* hath wonne the Girlond from them all, as we haue already prooued. *Arettæus.* *Theophilus.* *Oribasius.*

Who haue beene the chiefe Authors of Anatomy in our owne times.

CHAP. XIIII.

MAny things also haue the *Arabians* written of the matter of Anatomy, of whom *Auicenna* is worthily accounted, especially for the speculatiue part, the Prince and Chieftaine; but amongst all, the Latines haue taken most pains in this argument, and amongst them, those of our owne age; so that now the Art is so beautified, that it seemeth the last hand is put vnto it, and the art of Anatomy may now be accounted to haue attained the very height of her glorie. Among the ancientest of them, we haue *Mundinus*, who wrote very perspicuously by way of ἀνάλυσις, or resolution, following the order of dissection. *Carpus* wrote large Commentaries vpon him; but we must needes taxe them both with many ydle and absurd passages, besides the lameneſſe and imperfection of their workes. *Thomas de Zerbis* set forth a large worke, but we imagine that he tooke much from other men, and had little of his owne, neither had he as we suppose, any great practise himselfe in dissection. After these came *Vassæus*, *Carolus Stephanus*, *Andernacus*. At length appeared *Andreas Vesalius*, who wrote very accurately; and some thinke, he balked nothing that may appertaine either to Dissection, or to the actions or vse of the parts; but he is condemned of many, and haply not vnworthily; for that hauing transcribed almost all his worke out of *Galen*, yet hee cannot afford him scarse a good word, but either pricked by ambition, or with an itching desire to contradict so great an Author, he neuer leaues goading and wounding his reputation, and that very often vndeseruedly.

Auicen. Latine writers

Mundinus. *Carpus.*

Tho. de Zerbis.

Vassæus. *Caro. Stephanus* *Andernacus.* *Vesalius* an accurate writer.

Iacobus Syluius heerein hath carried away the reputation, that he hath digested in a most exquisite order, the vast and wilde Forrest as it were, and confusion of all the Muscles and Vessels, and giuen them particular and proper names, but hee was little beholding to his Printer, who hath let slip many escapes, and by your leaue added (as we thinke) somthings to him very superfluous. These two, *Vesalius* and *Syluius* flouriſhed both in one time; but *Vesalius* was too tart and sharpe in his calumniations, *Syluius* too obstinate a defender of *Galen*. *Vesalius* hath rashly and vnaduisedly written many things against *Galen*. *Syluius* in defending his Maister *Galen*, is enforced to maintaine many vncouth Paradoxes. *Gabriell Fallopius* the most subtile and acute Anatomist of this age, hath deserued exceeding much of vs all; for in his obseruations he hath opened many things altogether vnknowne to the former ages: he wrote also an excellent Commentary vpon *Galens* Booke *de Ossibus*. *Columbus* couched the whole Art very succinctly in xv. Bookes, and penned them very neatly. *Valuerda* the Spaniard hath done also exceeding well, and with great commendations. *Eustachius* hath published some small workes of Anatomy concerning the bones, and the frame and composition of the Kidneyes. *Bauhinus* first exceeded all men, and since in a later worke, hath exceeded himselfe, both in his descriptions, and in his Tables. *Archangelus Picholominæus* a Cittizen of Rome, hath set forth very learned readings of Anatomy, interlaced with many disputations concerning things controuerted. *Varolius Arantius* and *Pigafeta* haue added also their tribute vnto this treasury. *Volcherus Coiter*, and *Felix Platerus* haue beautified it with their Tables, *Volcherus* is more easie and facile. *Platerus* is acurate, but not fit Lettuce for euery mans lips, hee must picke nicely that will gather a Sallet out of him, hee is so intricate and full of his Dicotomies. Manie Frenchmen haue written well in their owne Language. *Iacobus Guillimæus* the Kings Chirurgion hath adorned the whole art with Tables and Figures, by which he hath made an easie entrance for all men to vnderstand the graueſt authors. The like may be saide of that industrious *Paræus*, and *Cabrolius* the kings Anatomist in *Mompelier*. *Seuerinus Pineus* hath taken great paines: he wrote a Booke of the notes of virginity, wherein he hath very curiously described the parts belonging to generation.

Fallopius his commendation.

Columbus.

Eustachius. *Bauhinus.*

Archangelus Picholomineus. *Var. Arantius* *Pigafeta.* *Volcherus Coeiter.* *Platerus.* *Guillemæus.*

Paræus. *Columbus.* *Pineus.*

Andreas Laurentius hath taken worthy paines, and sweare much in this sande, to his great honour and the generall good of the whole Schoole of Anatomists; for beside his descriptions, he hath handled learnedly the controuersies of euery part, with great euidence of argument, wherein I beleeue he hath satisfied himselfe and all the world beside. These his Controuersies we haue taken into our worke, yet not alwayes tying our selues to sweare what he sayes, but for the most part we finde him in the right. His descriptions wee take

Laurentius his cõmendation.

Bauhines diligence.

vnder correction, not to be so perfect, and his Figures most imperfect. In those two *Bauhine* hath farre exceeded him and all men else; to whom therefore we sticke the closer, although we could haue wished that *Bauhine* had had the care of his owne worke himselfe, & had not betrusted others with his credit, who haue in no few things fayled his expectation and ours.

Pauius.

Pauius of *Leiden* is a great Anatomist, but writes for his inscription, *Posse & nolle nobile.* Surely he can do much, and I would to God he could be ouercome, to communicate himselfe; some things we haue gathered from his owne mouth, whereof it shal neuer repent vs.

Iulius Casserius

Finally, within these three or foure years, *Iulius Casserius* the Anatomist of *Padua* in *Italy*, set forth an elegant Booke of the fiue sences, wherein he hath laboured sufficiently, if not too much; for there is a kinde of sobriety to be vsed also in humane studies, beyond which to be wise, is not farre from folly. *Casserius* hath done manie thinges excellently well, and of good vse, but his extraordinary diligence about the organs of the senses in so many creatures, I see no cause to imitate; for sure I am by that litle experience I haue, that many of these nice and fine points, though they make a faire shewe, and tickle the eares of a man when he reades them, and delight his eye when hee sees the resemblances of them printed before him; yet when he shall come to search for them in the bodye of man, they will not be so obuious, if they be at all, or if they be found, yet serue rather for a speculatiue pleasure & admiration, then be of any vse in the art of physick or Chirurgery.

Among our selues *Gemini* was the first: in his descriptions too breefe, in his Tables too confused, rather contenting himselfe with *Vesalius*, then giuing contentment vnto others: yet for those times he is worthily to be commended.

That good and ingenuous old man *Banister*, was a true patriot, he loued his Country & Learning, and spent himselfe in dooing good, and his memory is worthy to bee registred euen for his Anatomy among the rest of his Labours. At this day we haue also some worthy to be named, who if they listed, could turne the gaze of the worlde Westwarde, and time I hope will bring their monuments to light. In the meane time, we haue aduentured to hold vp this taper, at which if they please they may light their Torches.

Of the definition of Anatomy, and what Instruments are thereto necessary. CHAP. XV.

The notation of Anatomy.

TOMH is a Greeke word, and signifieth Section or cutting. Hence comes ἀνατομὴ, a diligent and curious Section, vndertaken to get knowledge or skil by. For ἀνατέμνειν, is to cut with great diligence. Now there is amongest Physitians, a double acceptation of Anatomy; either it signifieth the action which is done with the hande; or the habite of the minde, that is, the most perfect action of the intellect. The first is called practicall Anatomy, the latter Theorical or contemplatiue: the first is gained by experience, the second by reason and discourse: the first wee attaine onely by Section and Inspection, the second by the liuing voice of a Teacher, or by their learned writings: the first wee call Historicall Anatomy, the second Scientificall: the first is altogether necessary for the practise of anatomy, the second is only profitable; but yet this profit is oftentimes more beneficiall then the vse it selfe of Anatomy: the first looketh into the structure of the partes, the second into the causes of the structure, and the actions and vses therefrom proceeding. According to the first signification we may define anatomy thus: *An Artificiall Section of the outward and inward partes.*

Anatomy two fold. Historicall. Scientificall.

A definition of Anatomy. *Galen.*

I call it *Artificiall*, to distinguish it from that which is rash and at aduenture, which *Galen* calleth *Vulnerary* Dissection. For oftentimes in great wounds we obserue the figure, scituation, magnitude, and structure of the outward and inward parts; but that obseruation is but confused, for we cannot distinctly perceiue the branchings of the Nerues, the Serpentine and writhen Meanders of the Veynes, nor the infinite diuarications of the Arteries.

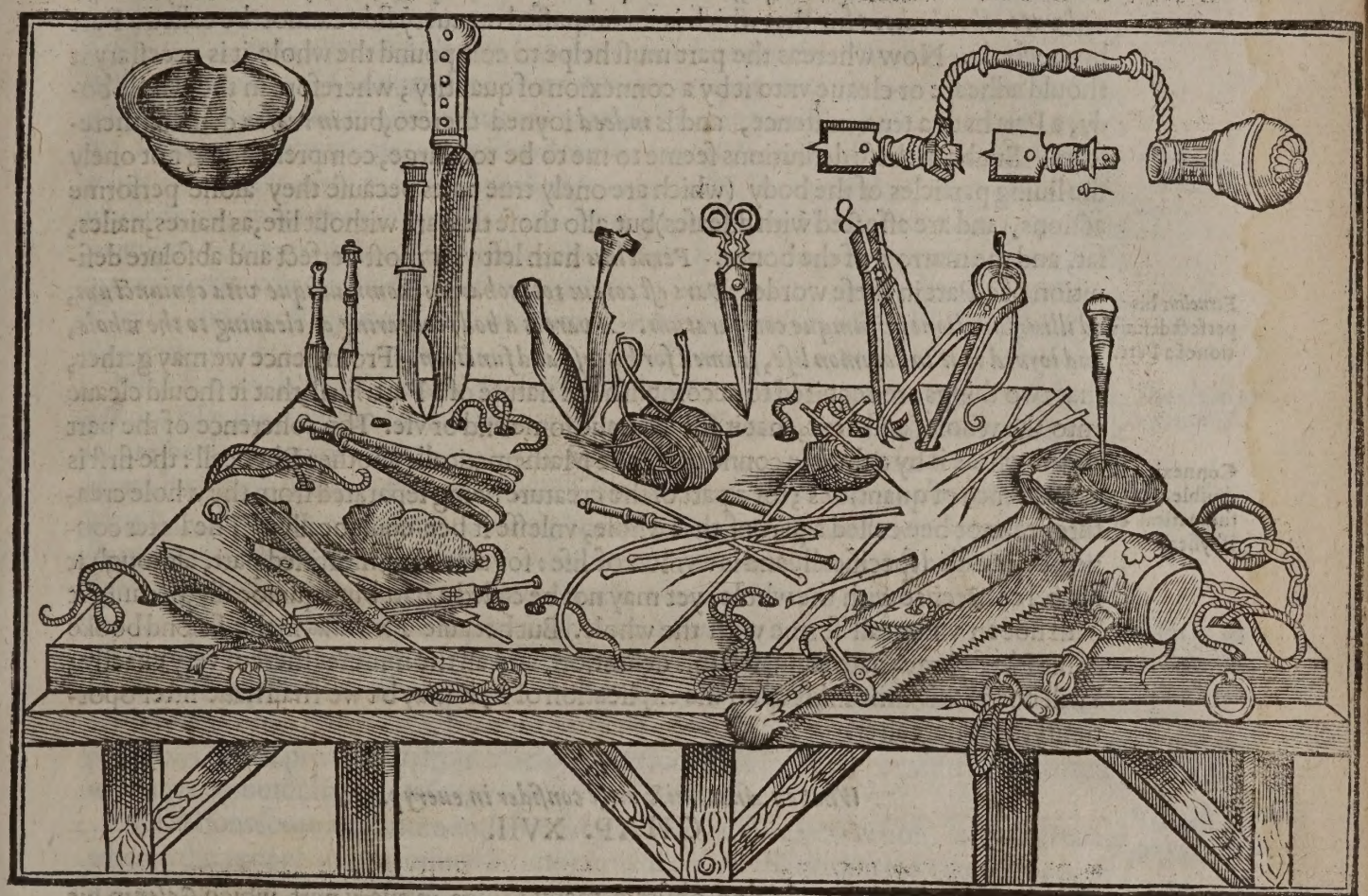
What thinges are required in artificiall Dissection.

Now that a Dissection may be made artificially, it is first requisite that the parts bee so separated one from another, that they may all be preserued whole, not rent and torne asunder. Next, that those which grow not togither, bee gently diuided. Thirdly, that those which do grow together, be carefully separated. Fourthly, that we mistake not many parts ioyned together for one, nor yet make many parts of one.

The Instrument of the Anatomy.

Now this Section cannot artificially bee accomplished, vnlesse the Ministers haue conuenient Instruments, as are these; Razors of all sortes, great, small, meane, sharpe, blunt, straight, crooked, and edged on both sides; Sheares or Sizers; round and large

long Probes of Brasse, Siluer, Lead; a Knife of Box or of Iuory, Pincers of all sorts; hooks, Needels bent rather then straite, Reeds, Quils, Glasse-trunkes or hollow Bugles to blowe vp the parts, Threds and strings, Sawes, Bodkins, Augers, Mallets, Wimbles or Trepans, Basons and Sponges; the Figures of all which wee haue heereunder delineated, together with a Table whereon to lay the dead, or binde the liuing Anatomy, with the rings, chains, cords, & perforations fit for that purpose.



If Anatomy be taken in the latter signification, it is defined a *Science or Art, which searcheth out the Nature of euery part, and the causes of the same Nature.* I call it a *Science*, because it hath vniuersall or generall Theoremes or Maximes, and common Notions, out of which, being the *First, true, immediate*, and *best knowne*, all demonstrations are framed. Vnder the name of *Nature*, I comprehend many things. The substance which is the habitation of the particular Faculty; the Temper which is called the forme of the similar part; those things which follow the Temper, as the qualities, such as may be felt, hardnes, softnesse, thightnesse or fastnesse, and rarity; thickenesse, thinnesse, sauours or tastes, and colours. Appurtinances also or accidents, as the composition of the part, to which I referre the magnitude, number, position, figure, continuity, and scituation; and finally the actions of the parts, and their vses.

Another definition of Anatomy.

What is the subiect or immediate obiect of Anatomy, to wit, a Part, where the definition of a Part is vnfo'ded. CHAP. XVI.

THE subiect of both kinds of Anatomy as well Historicall as Scientificall is a Part. For the Anatomist doth not handle a whole body, but a body diuided into members and parts; and therefore we must find out what is the nature of a Part, & the differēces of the same. A Particle, a mēber, a Place, μέρος, μόριον, τύπος, μέλος, signifie one & the same thing. *Aristotle* thought that the apellation of a Part did best agree to the similar particles, & of a Member to the Organicall and especially to those which were most cōpounded. *Theodorus* sayth that the name of a Part or place hath a larger extent then that of a Member, becaus that onely is a Member which is organicall, but all compound and simple particles are truely called parts. Wee with

The Names of a Part.

Aristotle.

Theodorus.

The definition of a Part.

Hippocrates and *Galen* make no difference betweene a part, a particle, or a place. *Galen* in the first booke of his method, defineth *a Part to be whatsoeuer doeth integrate or accomplish the whole*: and in his first book *de Elementis*, *whatsoeuer maketh to the constitution or frame of mans body*. For a Part is one of those thinges which the Logicians doe call τὰ πρός τι, that is, *haue reference or respect vnto another*: so a part is said to bee a part of the *integrum and whole*. In his first booke *de vsu partium*, he defineth a Part more accurately thus: *It is a body which neither is incompassed with a proper circumscription, nor yet is on euery side ioyned vnto other bodies*: for that which is incompassed on euery side cannot be called a Part but a whole. Now whereas the part must helpe to compound the whole, it is necessary it should adheare or cleaue vnto it by a connexion of quantity; wherefore in the whole body, a Part hath a true existence, and is *indeed* ioyned thereto, but *in reason* deuided therefrom. But both these definitions seeme to me to be too large, comprehending not onely the liuing particles of the body (which are onely true parts because they alone performe actions, and are affected with diseases) but also those that are without life, as haires, nailes, fat, and the marrow of the bones. *Fernelius* hath left vs a most perfect and absolute definition of a Part in these wordes: *Pars est corpus toti cohærens, communique vita coniunctum, ad illius functiones vsumque comparatum. A part is a body cohearing or cleauing to the whole, and ioyned to it in common life, framed for his vse and function.* From hence we may gather, that two things are required to accomplish the nature of a Part: First, that it should cleaue vnto the whole, and next, that it should haue some end or vse. The coherence of the part to the whole is by a double connexion, one Mathematicall, another Physicall: the first is a coherence of quantities; for a part of the creature being separated from the whole creature, cannot bee called a part of that whole, vnlesse it bee equiuocally. The latter connexion is called specificall, and is a vnion of life: for a dead or mortified part, although it haue a coherence with the whole, yet may not be called a part but equiuocally, because it hath not an vniuocall forme with the whole. But because *Fernelius* in the second booke of his Physiology, hath canuased this definition, and all the minutes thereof very exactly; I will not at this time insist vpon the explication of it, it may be we shall haue fitter opportunity for it hereafter.

Fernelius his perfect definition of a Part.

Connexion is double, Mathematical & Physical.

What an Anatomist must consider in euery part.
CHAP. XVII.

ANatomists doe obserue many things in euery part, which *Galen* in his bookes *de vsu partium* referreth to nine heads. We, the better to auoide confusion, least the wits of those that are ignorant should be too much racked, will consider onely three things, to which all the rest may bee referred, the *Structure*, the *Action*, and the *Vse*. The word Structure, I take here in a large signification, as *Aristotle* and *Galen* haue often taken it; not only for the conformation, but for whatsoeuer addeth or helpeth any thing to the constitution or composition of the part. Now these three things go to that constitution, the Substance, the Temper, and the Conformation. The substance (as wee said before) is the mansion of the particular and determinate faculty, and it is peculiar to euery part; and in that respect, the substance of a part is sayd to bee bony, membranous, neruous, fleshy, medullous or marrowy. This substance it hath partly from the forme, partly from the matter, and it is knowne by sensible qualities, such as are hardnesse, softnes, thicknes, thinnesse, raritie, density or thightnes, colour, and sauour or taste. The Temper accompanieth this substance and hangeth vppon it, following the materiall qualities; for it is not a thing abstracted or separated, but hath a firme coherence with the matter or substance, as with her subiect; and therefore the Physitians call the Temper, the forme of the similar parts, although indeede it bee not so much; but onely πρῶτον θερμικόν, that is, the immediate receiuer of the soule. This temper the Physitian especially standeth vpon; for euery part worketh thus or thus, according to and by his temper; and he that will maintain the actions or functions of the parts, must haue especiall care to preserue their true and genuine temper. In respect of this temper, the parts are sayd to be hot, cold, moyst, and dry; alwayes hauing a respect to a *medium*, that is, to a thing of a meane & middle temper, that is the skin. A hot and a cold temper wee distinguish rather by reason and discourse then by sence, because in a liuing creature there is nothing actually colde. But the moyst and

Three things are to be considered in a Part.

Structure what it is.

The substance of a Part what it is.

The Temper what it is.

and dry temper ſence onely diſcouereth, that is, the hardneſſe or ſoftneſſe of the part; for whatſoeuer appeareth hard to him that toucheth it, that we reſolue is dry, becauſe in a liuing creature there is nothing hard by concretion or curdling; whatſoeuer feeleth ſoft, is moyſt. The cõformation of a part conſiſteth in the Symmetrie, that is, the natural proportion or conſtitution of many things, to wit, of the figure, magnitude, number, & ſcituation. To the figure we referre the ſuperficies or ſurface, the pores and the cauities. To the ſcituation wee referre the ſeate and poſition of the part, as alſo his connexion with others; for the parts doe not hang looſe in the body, or ſeparated one from another, but they haue a coherence, being tyed together by ligaments and membranes. And therefore it behoueth a Phyſitian and Chirurgion to know which parts are tyed to which, that when one part is affected, he may know what parts may be drawne into ſimpathy and conſent with it. To this conformation *Galen* referreth the beauty of the part, which hee conceiueth to reſide in ἰσότητι, that is, in the *equality of the particles*; but wee place the beauty of the whole body, in the *inequality* of the parts; that is, in their vnlike and different quality and magnitude; but yet ſuch a difference as whereby the parts doe anſwere one another in an apt and neate correſpondencie of proportion, euen as muſique is made of different ſounds, but yet all agreeing in a harmonious concent; and thus much of the Structure of a part.

The conformation what it is.

The figure.

The ſcite.

The beauty of a part. *Galen.*

Next followeth the action, which *Ariſtotle* calleth *the end of the Structure*; becauſe for the actions ſake, the part hath his ſubſtance, temper, & conformation. So the heart, becauſe it was to be the manſion and habitation of the vitall faculty, and the ſtore-houſe of arteriall bloud, had giuen vnto it a fleſhy and ſolid ſubſtance, a temper hot & moyſt, a figure ſomewhat long, but comming neere to the Spherical, hollowed alſo with two ventricles or boſomes, and many obſcure cauities, in which the houſhold Goods and fire-harth of the body were to remaine, from whence there ſhould iſſue and ſpring a continuall ſupply of Natiue heat & ſpirits. I define an Action with *Galen*, *a motion of the working Parts*, or *a motion of the Actor*, to diſtinguiſh it from an affection; for an affection is a paſsiue motion, or a motion of a paſsiue or ſuffering body; but an action is *motus effectiuus*, an effectuating or working motion; ſo pulſation is an action of the heart; palpitation is an affection or a paſsion; the firſt proceedeth from a faculty, the ſecond from a ſickly or vnhealthfull cauſe, which we commonly call *cauſa morbifica*.

The action of a part. *Ariſt.*

What an action is. *Galen.*

Of actions ſome are common, ſome are proper; the common actions are found euery where; the proper are performed by one particular part. Nutrition is a common action, for all liuing and animated parts are nouriſhed, becauſe life is defined and limited by Nutrition. Proper actions are performed by a particular Organ, and they are either principall, or ſuch as miniſter to the principall: againe, of actions ſome are Similar ſome Organicall. A Similar action is begun onely by the Temper, and by the ſame is perfected, and is performed by euery ſound and perfect particle of euery part. The Organical is not commenced by the temper onely, neither is it accompliſhed by the particles, but by the whole Organ or inſtrument.

The differences of actions

Finally and in the laſt place, the vſe of the part muſt be conſidered by the Anatomiſt; For the Philoſopher ſayth, that wee are led vnto the knowledge of the Organ, not by his ſtructure but by his vſe. The Vſe which the Græcians call χρεία is two fold according to *Galen*. One followeth the Action; that is, ariſeth from the Action it ſelfe, and is the end of it; as by the Action of Seeing, the Creature hath this vſe, that hee can auoyde that which is hurtfull, and purſue that which is behoofefull. This Vſe, if you reſpect the generation and conſtitution of the part is after the Action; but in dignity and worth it is before it, becauſe it is the end of all actions: nowe the end is more excellent then thoſe things that appertaine or leade vnto that end. The other Vſe goeth before the Action, and is defined to bee *a certaine aptitude or fitnes to doe or worke*. So in the Eye the Chriſtalline humor doth primarily make the ſight; the other humors, the coates, the optick nerues afford a vſe, and are ordained to perfect the action of Seeing. This Vſe is in dignity behinde the Action, but in generation before it: by which it is manifeſt that the Action differeth, and is another thing from the Vſe, although many men vſe to confound them: for the Action is an actiue motion of the Part, but the Vſe an aptitude for Action. The Action is onely in operation, the Vſe remayneth alſo in the reſt or peace of the Member: the Action in euery Organ is onely the worke of the principall Similar part in that Organ, the Vſe is likewiſe of all the reſt: to conclude, there are many parts which haue vſe without any action, as the haires and the nailes.

The Vſe of a part. *Ariſt.*

The vſe is double. *Galen.*

How the vſe differeth frõ the action

The differences of Parts: and first Hippocrates his diuision of Parts.

CHAP. XVIII.

THE diuision of the diuine Senior, in his sixt Booke *Epide.* is of all other the most ancient, into ἴσχοντα, ἰσχόμενα καὶ ὁρμῶντα, that is, *Containers, contained, & those that are impetuous.* To vse the Martialists word, doe make impression. *Alexander* more plainely diuideth the body into στερεὰ, ὑγρὰ, καὶ πνευματώδη. that is, into *solid, humid,* and *spirituous* partes. Wee diuide them into parts Nourishing, to be nourished, and impulsiue parts. The containing parts are solid, & such as are to be nourished. The name of solide I do not take as the common people do, for that which is hard and tight, or dense; nor for that which is contrary to rare & hollow, but with the best Philosophers, by solid I vnderstand that which is τὸ ὅλον *tale*, that is, which is wholly full of it selfe, not of any other thing, or which hath a Nature, euery way like vnto it selfe. For *solum* and *solidum* in Latine, do come of the Greeke worde ὅλον, by changing the aspiration into a hissing, and so s. is set before ὅλον: and thus the fleshy parts also may be called solid & containing parts. So the Heart, a fleshy entraile containeth in his right ventricle venal, in his left arterial blood. So the marowy substance of the brain, which hath in it many dens and cauities, containeth both humours and spirits. We call also all solid parts to be nourished, because whatsoeuer is solid, the same is similar, and the action of a similar part is Nutrition.

What are cõtaining parts.

Contayned parts are the humors concluded or shut vp in their proper vessels and conceptacles, as it were in Store-houses. *Galen* calleth τὰ ὑγρὰ, that is, humours, τὰ ἐν τοῖς ἀγγείοις ἐμφερόμενα καὶ κατὰ πᾶν σῶμα διεσπαρμένα, that is, such as are contained in the vessels, and dispersed through the whol body. Some had rather cal them ἐνισχόμενα, *Things deteyned*, the better to signifie those things which are conteined within vs, as also which do preserue the substance of the part: and therefore we haue called them Nourishers, to restraine the word *Humors* to the Alimentarie, and not to include the Excrementitious. ὁρμῶντα or ἐνορμῶντα, that is, impulsiue or impetuous thinges, *Fernelius* referreth to the faculties of the soule, not to the spirits; but in my opinion he is in this out of the way. For though the spirits be conteyned, and haue proper conceptacles, to wit, the veynes, arteries and neruers, yet they are truly called impulsiue substanecs; and *Hippocrates* spake of the body & bodily things, & therefore not of the Faculties, which are but abstracted Notions. Now by the word Spirit, I do not vnderstand a wind, for these are ψευδοπνεύματα, *Bastard*, or as *Auicen* termeth them *Fraudulent* spirits, whose violence is sometimes so great & furious, that they are the cause of many tumults in the household gouernement, or naturall constitution of the body, which is oftentimes miserably distressed with their furious gusts: read what *Hippo.* in his Book *de Flatibus* hath written of the power of winds. But by spirits we vnderstand the primary and immediate instrument of the soule, which the Stoicks calleth *the Band which tyeth the soule and the body.* The force of these spirits is such, & so great the subtilty and thinnesse of their Nature, that they can passe suddenly through all parts, & do insinuate themselues through the fastest and thickest substances, as wee may perceyue in the passions of the minde, in sleepe and in long watchinges. By the ministerie of these spirits, all the motions of liuing creatures are accomplished, both naturall, vitall, and animall, and by these, life, nourishment, motion and sence, do flow into all the parts. Finally, the motion of the spirits is perpetuall, both of themselues, and by another. By themselues, that is, they are mooued continually from an inbred principle both wayes, vpward and downward; vpward because they are light, downward toward their norishment. They are mooued by another when they are driuen, and when they are drawne. The vitall spirits are driuen, when the heart is contracted, the animall when the braine is compressed. The spirits therefore are ἐνορμῶντα, impetuous substances. They are fiery and ayery, and therefore very fine, subtle, and swift: so the seede although it be thicke and viscid, yet in a moment it passeth through the vessels of generation, which haue no conspicuous cauities, and that because it is spirituous, or full of spirits.

What are contained parts.

Hippocrates

Auicen.

Hippocrates

The continuall motion of the spirits.

Their motion double.

Per se & aliud

There are also other differences of parts, according to *Hippocrates* in his Booke *De veteri medicina*, which are drawne from their substance, figure, and scituation. From the substance some are dense, others rare and succulent, or iuicy, others spongie & soft. From the figure, some are hollow, and from a largenesse gathered into a narrownesse or constraint,

Differences of parts according to Hip.

Impetuous or impulsiue things as the Spirits.

ſtraint, others are ſtretched wide, others ſolid and round, others broad & hanging, others extended, others long. From the ſcituation ſome are Anterior, ſome Poſteriour, ſome deepe, others middle, vpper-moſt, lower-moſt, on the right hand, and on the left.

A diuiſion of Parts into Principall, and not principall.

CHAP. XIX.

THE diuiſion of parts into principall, and leſſe principall, is verie famous, and hath helde the Stage now a long time. We deſine, that to be a Principall part, which is abſolutely neceſſary for the preſeruation of the *Indiuiduum* or particular creature. Or, which affoordeth to the whole bodie, a faculty, or at leaſt a common matter. In both ſenſes, there are only three principall parts, the Braine, the Heart, and the Liuer; the Braine ſitteth aloft in the higheſt place, as in the Tribunall or Iudgement ſeate, diſtributing to euery one of the Inſtruments of the ſences, their offices of dignity. The Heart (like a King) is placed in the midſt of the Cheſt, and with his vitall heate, doth cheriſh, maintaine, and conſerue the life and ſafety of all the parts. The Liuer, the fountaine of beneficall humor, like a bountifull and liberall Prince at his proper charges, nouriſheth the whole family of the bodie. From the Braine, the Animall Faculty by the Nerues as it were, along certaine Chords, glideth into the whole frame of Nature. From the Heart, the Vitall ſpirits are conueyed through the Arteries, as through Pipes and Watercourſes into euery part. From the Liuer, if not a Faculty, yet a Spirit; if not a Spirit, yet at leaſt a common matter, to wit; the blood is diffuſed by the veynes into euery corner. So that onely three are abſolutely neceſſary for the conſeruation of the whole *Indiuiduum*, the Braine, the Heart, and the Liuer, all which are fitted and tyed together in ſo ſtraite a conſpiracy, that each needeth the helpe of the other; and if one of them faile, the reſt periſh together with it. Not that I thinke theſe parts are of equall dignity, for the Heart is more noble then the Liuer, & the Braine more excellent then the Heart, aſwell becauſe his actions are more diuine, becauſe the ſeate and Pallace of Reaſon, which is the Soule; as alſo, becauſe all other parts are but handmaides vnto it: and beſides, *Hippocrates* ſaith, it giueth the forme to the whole body, *For* (ſaith he) *the figure of the reſt of the Bones, dependeth vpon the magnitude of the Braine, and the Scull.*

What is a principal part

Three principall parts.

The Braine more excellent then the Heart.

Hippocrates

Galen addeth to the Principall parts the Teſticles, becauſe they are the chiefe Organs of procreation, by which alone, the ſpecies or kinde is preſerued. But we thinke that they confer nothing to the conſeruation of the *Indiuiduum* or particular creature, becauſe they neuer affoord any matter to the whole body, neyther faculty or ſpirit, but onely a qualitie, with a ſubtle and thin breath, from whence the fleſh hath a ſeedy rammiſhneſſe, a harſh taſte, and ſtrong ſauour, and the actions of ſtrength and validity. All the reſt of the parts may be called ignoble compared to theſe, aſwell becauſe from them proceedeth no faculty, ſpirit, or common matter, as alſo becauſe euery one of them, do miniſter to ſome one or other of the principall parts. So the Organes of the ſenſes ſerue the Braine, and were created for his vſe & behoofe: ſo the Lungs, the Midriffe, & the Arteries as ſwel ſmooth as rough, were ordained only for the tempering and repurgation of the hart. ſo the Stomack, the Guts, the Spleen, both the bladders of Vrine and of Gall, were made for the Liuer: and in a word, none of theſe ignoble parts are of neceſsity for the conſeruation of the creature, or if they be neceſſary, it is not ἁπλῶς, that is, *ſimply* and *abſolutely*, but *ſecundum quid*, that is, as they are neceſſary to ſerue the turne of the Principall. For I pray you what vſe hath the arme, the legge, or the ſtomacke of the Lungs, the Spleene, and the Kidneys? Again, what neceſſary vſe haue the Lungs, the Spleene, and the Kidneyes of the Legs or Armes? But to all theſe the heart giueth life, the Liuer nouriſhment, and the Braine ſenſe and motion, ſo that the Braine, the heart, and the Liuer, are in all the parts of the bodye, by the mediation of their veſſels.

Galen.

How the Teſticles may bee called principall parts.

What parts are called ignoble & why.

Now, as there is not an equality of dignity among the principall parts, ſo the ignoble parts are not all of one and the ſame degree. For ſome of them ſerue the principall, by preparing ſomwhat for them, others by carrying or leading ſomewhat vnto them. There are alſo ſome ſorts ordained onely for the expurgation or cleanſing of the principall, which are the moſt ignoble of all the reſt, and are commonly called Emunctories or Drayners. So for the Liuer the Stomacke boyleth the Meate, the Veynes of the Meſentary giue the blood a kinde of rudiment or initation; the Caue or hollow veyne diſperſeth the blood al-

The differencles of the ignoble parts.

Emunctories.

already perfected. For the heart, the Lunges prepare the ayre, the pipes of the great arterie carry about the vitall ſpirits. For the Brain, the wonderful texture or plighted web of veſſels prepareth the animall ſpirit, and the nerues diſtribute it into the whole body. Behinde the eares are the Emunctories or draynes of the Braine; vnder the arme holes ſo many glandules or kernels which receiue the ſuperfluities of the Heart, and in the leske or groyne are the Emunctories of the Liuer.

An Elegant diuiſion of Parts into Similar and Diſſimilar, and an exquiſite interpretation of the ſame.
CHAP. XX.

THE moſt frequent diuiſion of the parts among Philoſophers and Phyſitions both, is into Similar and Diſsimilar, which is alſo the moſt neceſſary for the exquiſite diſquiſition and diſtinction of diſeaſes. The Similar parts, *Plato* first called πρωτόγονα that is, *first borne*, becauſe according to the order of generation, they are after a ſort before the compound parts; and becauſe they are the firſt *Stamina*, threds, or warp of the body. *Ariſtotle* calleth them ἁπλᾶ καὶ ἀσύνθετα μέρη that is, *ſimple and vncompounded parts*, becauſe they are not compounded of other parts, or elſe πρός τι, that is, *in reſpect of the compounded*: for they are not indeede and truely ſimple, for the body of the Creature being not ſimple; neither can the parts of it be truely ſimple.

All the names of the ſimilar parts. *Plato.* *Ariſtotle.*

First *Anaxagoras*, and after him *Ariſtotle*, brought in the name ὁμοιομερείας *of ſimilitude*, whence they are called Similar, becauſe they haue one and a like ſubſtance. Some call them πρόσεχη μέρη, that is, *continuall Partes*, becauſe they are continually the ſame both in matter and forme. Others call them *Informes*, *without forme*, but wee thinke it better to call them *vniforme parts*. *Ariſtotle* called them *ſenſorias*, becauſe that which is Similar is capable of ſenſible obiects, and all ſence originally proceedeth from the ſimilar parts. *Galen* calleth them ſometimes *ſenſible Elements*, becauſe they appeare to the ſences moſt ſimple and vncompounded; ſometimes ἐλάχιστα στοιχεῖα, that is, the *leaſt particles*. Sometimes the *firſt*, ſometimes the *laſt bodies*; *Firſt*, in reſpect of their compoſition; *laſt*, becauſe into theſe, the body is diſſolued as into the leaſt parts that may bee perceiued by the perceiuing ſences. Some call them *Solid*, not becauſe they are conſtant, euer conſiſting and neuer diffluent (for then the fleſh ſhould be no Similar part) but becauſe they are euery way full and compleate. The common people call that Solid, which is hard, denſe, or compacted; for water or a ſponge, they will neuer acknowledge to bee ſolid: but the Philoſoper calleth that ſolid, which is wholly full of it ſelfe, and of no other thing, which is of a like or of the ſame nature; ſo the fire in his owne globe, and the Heauen (although they bee moſt rare and ſubtile bodies) yet true Philoſophers will call them ſolid bodies. *Hippocrates* calleth them ὀγκώδεα, that is, *containing Parts*: but enough of the name, now let vs come to the eſſence of the ſimilar parts.

Anaxagoras. *Ariſtotle.* *Ariſtotle.* *Galen.* What is a ſolid part. *Hippocrates*

A Similar part may haue a double conſideration, one in reſpect of the matter, an other in reſpect of the forme: if you regard the matter, which is altogether one and the ſame, in all partes likevnto it ſelfe; then ſhall ſimilar partes bee defined according to *Ariſtotle*, ὅσα διαιρεῖται εἰς ὁμοιομερῆ *which are deuided into parts like vnto themſelues*, according to *Galen*. *All whoſe particles are like to themſelues and to the whole*: Or *which are deuided into parts not differing ſpecie, or in kinde*. If you reſpect the forme of the ſimilar parts, then they ſhall be defined, *Such as haue a vniforme figure*. For, becauſe the forme giueth the proper denomination to euery thing, that ſhall be called *ſimilar*, which hath a ſimilitude or likeneſſe of forme and figure. In the firſt conſideration or reſpect, euery particle of the ſimilar part retayneth the name of the whole, but not in the latter: ſo the bone of the Leg becauſe of the ſimilitude of the matter is vniforme, but if you reſpect his figure, then are not all his parts of the ſame nature, for euery little particle of that bone is not hollow, though the whole bone be hollow. Hence we may gather that euery ſimilar part may bee ſayd to be organicall, and that they do not well who oppoſe ſimilar and organicall parts for *deuiding members*, as we ſay in Schooles: for among Philoſophers, the nature of the part and of the whole is the ſame. The whole body is organicall, becauſe *the ſoule is an act of an organicall body*.

A ſimilar part hath a double conſideration. A definition of a ſimilar part. *Ariſtotle.* *Galen.* Euery ſimilar part may be ſayd to be organicall. *Membra diuidentia.*

The eſſence of the ſimilar parts ſeemeth to conſiſt of an vncertaine medley of the Elements,

The eſſence

ments, and a temper of the foure first qualities, heate, cold, moysture, and drought. And therefore the Physitians say, the Temper is the forme of the similar parts, because it is πρῶτον ἀκτικὸν, *The first receiuer* and the first power with which, and by which, the forme worketh; and the similar part, as it is similar, suffereth whatsoeuer the forme worketh. So Nutrition, which is the common action of the similar parts, is inchoated or begun by the temper alone, by it perfected, and plenarily and perfectly accomplished by euery particle of the part.

The differences of the similar parts, are some of them belonging to the Philosopher, some to the Physitian. The Philosopher raiseth his differences from the first qualities, and those which follow the temper. The Physitian from the sensible and materiall principles of generation. The first qualities are indeed foure, but because heat and cold are certain acts, and an acte is according to it selfe indiuisible, therefore the Philosopher raiseth his differences only from the diuersity of drowth and moisture. Wherefore *Aristotle* maketh similar parts, some dry, some moist. The moyst are either properly so called, that is, such as of their owne nature cannot containe themselues within their owne *termini* or limits, and therefore do stand in neede of conceptacles or receptacles, as the bloud; or else are softe, which do better contain themselues within their bounds, as flesh. The dry are those whose Superficies or Surface is pressed, and yeeldeth either not at all, or very hardly: and such he calleth στερεὰ, or στερεὸν μέρος, that is, *solid* parts; of which he maketh two kinds. Some are fragile or brittle, which cannot be bent without the dissolution of the part, as Bones; others, are tough or stretching, which may bee bent and extended without dissolution, as Ligaments and Membranes.

The differences of similar parts.

A Philosophicall diuision of them into moyst & drie. *Aristotle.*

The Physitians do gather the differences of similar parts, from the sensible and materiall Principles of generation. There are two materiall principles, the Crassament or substance of the seede (for onely the spirits or the workemen) and Bloud: and therfore some parts are spermaticall, and some fleshy. The first are immediately generated out of the Crassament of the seede, the latter of bloud: the first in growne and olde men, do hardlie reunite κατὰ πρῶτον σημαῖον, *according to the first intention*, as we vse to speake, because of the weakenesse of the efficient; (for they are colde) because of the vnapt disposition of the matter, whose affluence is no confluence, that is, it floweth not together-ward and ἀθρόως, *at once*; & because it must passe through many and diuerse alterations; ad heereto the ficcity and hardnesse of the parts; for dry things do not easily admit a vnion or consolidation, and the Philosopher in all mixtion requireth a watery moisture, that by it as by Glue all partes may be vnited. On the contrary, fleshie parts, because they are hotter, softer, and nourished with bloud little or nothing at all altered, do presently reunite and close together, sometimes without any meane immediately; sometimes *per medium homogeneum*, that is, by a thing of the same kinde.

The Physitians diuision of them into spermaticall and fleshy.

There are diuers differences of spermaticall and fleshy parts. For the seede, though it seeme to be similar, vniforme, and euery where like it selfe, yet hath it parts of a different Nature, some thicker, some thinner, some fat, some slimie, some fit for stretching, others for concretion, or to be gathered together. Whilst therefore the procreating vertue worketh vpon that part of the seede which can extend it selfe, it maketh Membranes, Veines, Arteries and Nerues; when vpon that which is fitter for concretion, it formeth bones and gristles; when the fat is more then the glutinous matter, then are bones & gristles formed.

The differences of spermatical parts.

Againe, *Galen* obserueth in the spermaticall parts, a double substance, that which is truly solid, and that which is fleshy; the first may be moistned, but not restored; the other is as it were a concreted or congealed liquor, cleauing to the solid Fibres. There are three kinds of fleshy parts, three sorts of flesh. One *Flesh* properly so called, to wit, that of the Muscles, which therefore *Hippocrates* calleth absolutely σάρκας, that is, *Flesh*. There is another flesh of the Bowels or inward parts, which we call enteralles and περιέγχυμα, as it were an affusion or confluence of blood. There is also another flesh of the particular parts.

Galen. In spermaticall parts ther is a double substance. Three sorts of flesh. *Hippocrates*

A third diuision of the similar parts.

We will adde a third diuision of similar parts, into Common and Proper. I call those Common, which make and constitute many parts compounded of an vnlike and different Nature, as the Bones, Gristles, Ligaments, Membranes, Flesh, Nerues, Veines and Arteries. Of which, the first fiue are truly similar, the others only according to sence: for the inner substance of a nerue is medullous, the outward membranous. I call those Proper, which do make the substance onely of one part, and such as is not found elsewhere; such are the marrowy substance of the Braine, the cristalline and glassy humors of the eye. Of

all

The necesſity & vſe of ſimilar parts. *Auerrhoes.*

al ſimilar parts there is a double neceſsity: one, that of them diſsimilar parts may be compounded; the other I find in *Auerrhoes*, that they may be the ſeat of the Senſatiue vertues, for all ſence commeth by the ſimilar parts.

What is a diſſimilar part.

To the ſimilar part, we oppoſe the diſsimilar; for as the ſimilar part is, or may bee diuided into particles of a like, ſo diſsimilar into particles of an vnlike or different kinde: as the particles of the ſimilar part retaine the name of the whole, ſo the particles of diſsimilar parts haue no names at all. Wherefore we define diſsimilar parts to be; ſuch as are deuided into parts of a different nature and diuerſe kinde. Theſe the Phyſitians κατ' ἐξοχὴν by way of *exellence* doe call Organicall, becauſe their action is more perfect and euident, as alſo becauſe the neatnes of the figure, the magnitude, number and ſcituation (which foure accompliſh the Nature of an organ) do more plainly appeare in compounded parts then in ſimple; ſo that both in reſpect of the forme and of the actions, they are more properly called the Organs of the Soule; for the forme of the ſimilar parts is the Temper, of diſsimilar a laudable conformation: now conformation doth better anſwere the functions of the ſoule, then doth the Temper, becauſe the ſoule is defined to be *an act of an organicall body*. The action of the ſimilar is Naturall, to wit, Nutrition, as beeing manifeſt euen in plants; the action of the diſsimilar part is Animall, and therefore that is ſayde to bee the action of Nature, this of the Soule. Furthermore, I define an organ (with the ancients) to be a part of the Creature which can performe a perfect action; by perfect I vnderſtand proper: for the action of the ſimilar parts is common, not proper. *Galen* maketh foure orders of organs or inſtruments; the firſt is ſuch as are moſt ſimple, which conſiſt onely of ſimilars, as the muſcles. The ſecond are thoſe that are compoſed of the firſt, as fingers. The third are ſuch as are made of the ſecond, as the hand. The fourth are ſuch as are made of the third, as the arme. Againe, in euery perfect organ we may obſerue foure kindes of parts; The firſt is of thoſe by which the action is originally performed; where theſe are, there is alſo the faculty; and therefore they are ſaid to bee the principall parts of the organ; ſuch is the Chriſtalline humor in the eye, for it onely is altered by colours, and receiueth the images of viſible things. The ſecond kind is of thoſe without which the action is not performed, and theſe doe not reſpect the action primarily and *of themſelues*, but the neceſsity of the action; ſuch are in the eye, the optick nerue, the glaſsie humour, and the albuginious, which is like the white of an egge. The third kinde is of thoſe by which the action is better performed; and theſe reſpect the perfection of the action, and therefore are called *Helpers*, ſuch are in the eye, the coates and the muskles, which moue and turne the eyes with a wonderfull volubility. The laſt kinde is of thoſe parts which doe conſerue or preſerue the action; theſe are the cauſes that all the reſt do worke ſafely; & they reſpect the action, not as it is an action ſimply, but as it is to continue and indure; ſuch in the eyes, are the browes, lids and orbe of the eye; and this is the nature of diſsimilar and organicall parts.

The diſſimilar parts are rather the inſtruments of the ſoule then the ſimilar.

What an Organ is.

Foure orders of Organs.

In a perfect Organ there are 4. kinds of parts.

Perſe.

Another diuiſion of diſsimilar parts.

But that we might not paſſe ouer any thing, wee will adde this one for a complement; that of diſsimilar parts, ſome are ſuch by the firſt inſtitution of nature, as the hands and the feet, from which if you take all the ſimilar parts, you ſhall reduce them into nothing; others are diſsimilar ſecondarily, becauſe of the implications and textures of veines, arteries, and ſinewes in them, as the Heart, the Braine, and the Liuer; for if you take from the Braine the common ſimilar parts, yet there will remaine the proper ſubſtance of the Braine.

The other differencies of the parts are vnfolded.

CHAP. XXI.

Galen maketh 4. differences of parts.

THere are alſo other differences of parts not ſo neceſſary for a Chirurgion to know, which notwithſtanding becauſe we would leaue nothing behinde vs, we will briefly declare. *Galen* in his Booke *de arte parua*, maketh foure differences of parts: ſome parts are principall, as the Brayne, the Heart, the Liuer, and the Teſticles. Some doe ariſe from theſe principal and miniſter vnto them, as nerues, veines, arteries, and ſeede veſſels; ſome neither gouerne others, nor are gouerned of others, but haue only in-bred faculties, as bones, griſtles, ligaments, membranes. Finally, ſome parts haue vertues both *in-bred*, and *influent*, as the organs of ſence and motion.

How the *Arabians* diſtinguiſh the parts.

The *Arabians* gather the diuiſions of parts, from the ſubſtance, the Temper, thoſe things which follow the temper, and thoſe things which are accidentarie or happen to the part: whence ſome parts are fleſhy, ſome ſpermaticall; ſome hot, others cold;

ſome

some moyst, others dry; some soft, others hard; some mooueable, others immooueable; finally, some sensible, others insensible. Those which haue sence, haue it either sharpe and quicke, or stupid and dull. A part is saide to haue exquisite sence three wayes, either because of the perfection of the sense, so the skin which couereth the palme of the hand, and especially the fingers endes, hath an exact perception of the tractable or touchable qualities; or because it is more easily and sooner violated and offended by the internal and externall qualities which strike the sence; so the eye is saide to be of very acute and quicke sence: or because it hath a determinate or particular sence, which no where else is to bee found; so the mouth of the stomacke is of most exquisite sence; that it might apprehend and feele the exhaustion or emptines, and the suction or appetite of the other parts: so also the parts of generation in both sexes, haue in them a strange and strong desire and longing after their proper satisfaction.

The Anatomists commonly do diuide the whole body into the Head, the Chest, the lower belly, and the ioynts. The Egyptians into the head, the necke, the chest, the hands, & the feet. *Diocles* into the head, the chest, the belly, and the bladder. *Fernelius* in the second Book of his Method, diuideth the body into publicke and priuate Regions: and truely as I thinke very commodiously, for a practising Physitian or Chirurgion. The publick Region is threefold: One, and properly the first, reacheth from the Gullet into the middle part of the Liuer; in which, are the stomacke, the Meseraicke veynes, the hollow part of the Liuer, the Spleene, and the *Pancreas* or sweete bread between them. The second runneth from the midst of the Liuer, into the small and hairy veines of the particular partes, comprehending the gibbous or bounding part of the Liuer, all the hollow veine, the great arterie that accompanieth it, and whatsoeuer portion of them is betweene the armeholes & the Groine. The third Region comprehendeth the Muscles, Membranes, Bones, and in a word, all the *Moles* or mountenance of the body. There are also many priuate Regions, which haue their proper superfluities, and peculiar passages for their expurgation.

The Egyptians diuision of the bodie.
Diocles.
Fernelius his excellent diuision of the bodie.

And thus me thinkes, I haue run through the nature of Man, the Excellency, Profite, Necessitie, and Method of Anatomy, who haue written therof as well in olde times, as of later yeares, and among our selues; the definitions & diuisions of Anatomy, the Subiect or proper Obiect of the same, the nature of a Part, with the differences and distributions of the same: it remaineth now, that we vntie such knots as might in this entrance intangle vs, and so hinder our progresse to that wished end which we set before vs.

A Dilucidation or Expoſition of the Controuerſies concerning the Subiect of ANATOMY.

The Præface.

AS in the knowledge of Diuine Myſteries, Implicit Fayth is the highway to perdition, ſo in humane learning, nothing giues a greater checke to the progreſſe of an Art, then to beleeue it is already perfected and conſummated by thoſe which went before vs; and therfore to reſt our ſelues in their determinations: For if the ancient Philoſophers and Artiſts had contented thẽſelues to walke onely in the Tracke of their predeceſſours, and had limited their Noble wits within other mens bounds, the Father had neuer brought foorth the Daughter, neuer had Time broght Truth to light, which vpon the fall of *Adam* was chained in the deepe Abyſſe. There is, as of the World and gouernement thereof, ſo of arts a frame, the matter whereof comes downe from heauen, but is gathered heere by diſcourſe of reaſon and experience. The beauty and glory of whoſe Columns wer not perfected in one age, but the ground worke was firſt laid in the times which were neereſt to the Originall of Nature; afterward addition was continually made by the vigour of the ſoule of Man, and ſhall be vnto the end of the world. It were not hard to giue inſtances heereof in all arts, nor happely would it be very tedious; but it ſhal bee ſufficient (to auoyd prolixity) to inſiſt a little vpon generals, and ſo deſcend vnto our owne art we haue in hand. The firſt man (ſaith the Diuine ſtory) ſaw all the Creatures, and gaue them names according to their Natures, but that Sun-ſhine was ſoone clouded, that Image defaced, that ſtampe battered by his fall. Afterwards, as a Marchant that had loſt all his inheritance in one bottome, he was to begin the world anew, and to gather an eſtate or ſtocke of knowledge, by the trauell and induſtry of his ſoule and body; yet was not his ſoule *Abraſa Tabula*, a playned Table, there remained ſome Lineaments which the Scripture calleth *The Lawe of Nature*; not ſuch as could exhibite any ſufficient originall knowledge, but ſuch as whereby, hauing gotten knowledge from without himſelfe, might make him again acknowledge the darke and defaced foot-ſteppes that remained in himſelfe, and to poliſh and refreſh them ſomewhat, though it was impoſsible to reduce them to the former perfection. Thus the ſoule by diſcourſe of reaſon, that is, by her owne acte, knewe her naturall immortality, and by induction of particulars, came to informe her ſelfe of the Natures of other things: not as ſhe knew before, from the vniuerſall to particulars, but by gathering particulars together to frame generall and vniuerſall notions.

Rom. 2.

And ſurely in the firſt age, by reaſon of their long life, and conſequently of their infinite obſeruations, haply alſo becauſe they were neerer to integrity of nature, the Defection not being ſo ſuddenly confirmed, men laide the grounds of arts, which were deliuered by tradition from the firſt Fathers ſimply and faithfully; but afterward by enuy or corruption were wrapped vp in Myſticall Hierogliphickes, or poyſoned with ſuperſtition, or forfeited by negligence, many of them alſo were worne out by length of time, for want of Letters and meanes to preſerue them. Thoſe which remained, ran in Families, and from Families were

were deuolued vnto Nations as the world encreaſed; Firſt as is ſuppoſed to the *Chaldeans*, then to the *Phœnitians*, after to the *Egyptians*; all which as the Nature of man is prone to worke vpon that, it can leaſt attaine vnto; or elſe, becauſe the Diuinity of the ſoule findeth no contentment, in that ſhe conceiueth to be leſſe then her ſelfe, did therefore neglect all ſublunarie things, & applyed it ſelfe to ſpeculations of heauen and heauenly bodies, wherein they were farthered by that olde and cunning Serpent, who put to his helping hande to ſeduce them from the acknowledgement of their owne imperfection, by goading them forward in an addle and veine diſquiſition of friuolous and impious ſecrets. So the tradition of God, as being of too high a pitch for their imped wings, was peruerted vnto an vnknowne *Numen*; the Tradition of the Angels into feigned ſpirits, gouerning the motions of the Heauens. That of the true vſe of the Starres into iudiciall and Genethliacal Aſtrologie. That of the fall of *Adam* and *Eue* into the Fable of *Iſis* and *Oſyris*. The Deluge into *Deucalions* flood. The Diuinity of the minde and ſoule, into the tale of *Mitris* and *Arimanis*, and a world of ſuch ſuperſtitious toyes. And verily almoſt all ſuch was the learning of the former ages, till the Græcians fell vpon the grounds of Demonſtrations: and then men firſt began to fall from thoſe abſtruſe and tranſcendent contemplations, and to bring home Philoſophy vnto themſelues. Their Metaphyſickes were Logicall, their Phyſicks Elementary; the Diuinity of the ſoule was tyed to the Principles of generation, and ſuppoſed to reſult out of the power of the matter of the body: and in a word, Philoſophy fell from heauen into the Elements, wherein they ſo accumbred themſelues, and thoſe that followed them, that to this day we are ſcarſe vninthralled from them. Yet there wanted not ſome, who laboured in all kindes, to bring Learning to better thrift. *Homer*, *Hippocrates*, *Plato*, all of them in their kindes, the very Oracles of Philoſophy, ſo as we may truelie ſay, that whatſoeuer we haue ſolide and ſubſtantiall, it is but deriued from theyr Fountaines.

Neyther were theſe men onely happy in their owne ſublime and diuine wits and apprehenſions, but alſo in their Interpreters, *Virgil* to *Homer*, *Ariſtotle* to *Plato*, and *Galen* to *Hippocrates*. The former two we let paſſe, as belonging to another Forum. *Hippocrates* as the firſt head of our Tribe, the Father and founder of the Family of Phyſitians, lefte a goodly inheritance to his poſterity, which *Galen* (to paſſe by the reſt) hath not miſpent, but much improoued, and wee who are *Artis Filij* may worthily be accounted decoctors and prodigals, if we keepe not our Patrimony together; nay, in this kinde of Thrift, not to go forward, it is to go backeward. Yet I muſt confeſſe, that after *Galens* time, and his Epitomizer *Oribaſius*, who liued but in the next age, Anatomy (for that is the ende wee driue at,) lay raked vp *Patrio in puluere*, till within ſome of our Memories, *Veſalius* albeit ſomewhat importunately, yet verie Learnedly, blew vp the almoſt deade ſparkes into a moſt Luculent Flame, at whoſe Beacon, all ſince his time haue teened theyr Torches, though happelie beeing put together, they may ſeeme to dimme his light by their multitude.

There is, and will alwayes be left *Locus Philoſophandi*, ſcope enough, euen in this Little World for ſuch as liſt to exerciſe themſelues; and many haue with no ſmall commendations made proofe of their agility, yet we muſt needes acknowledge, that the Groundworke of the building, and not onely ſo, but the whole frame was by the ancients reared vp; and therefore now if any Ornaments be added, they muſt be fitted thereunto. Wherefore, we haue laboured to bring all the ſubtilties and nouell inuentions of the later Writers, to the Touch-ſtone of the ancients Monuments; that as no man ſhould be defrauded of his due Commendation; ſo the Crowne may remaine, where with ſo much duſt and ſweate it was gloriouſly merited; whereby we do not deſire to be accounted amongſt the number of the Antagoniſts, but as a Herald of *Honor*, do indeauor to marſhall the fielde, and ſometimes where the caſe is cleere, to ioyne in vmpeirment with the Spectators; or where it is difficult to aſsiſt them.

Of the definition of a Part. QVEST. I.

Hippocrates the oracle of Physicke. *Galen* his interpreter. Words synonymal.

Hippocrates, whose happy workes are the very Oracles of our Arts, and *Galen* his interpreter, doe promiscuously vse the names of a Part, a Member, and a Place, for the same thing. The *Eye* (sayth *Galen* in the first Book of his Method) *we call a Member; neyther is there any oddes which you call it, a Member, or a Part: if any man shall say the Eye is a Part and not a Member, or a Member, and not a Part; I will not in either contend with him.* In his first Book *de locis affectis*; *Not onely the latter Physitians* (sayth he) *but many also of the antients doe vse to call the particles of the body, Places.* *Hippocrates* in his Book *de locis in homine*, and *de victus ratione in morbis acutis*, calleth also Parts, *Places*: yet there are some who distinguish a Member from a Part, and a Particle from a Place. *Aristotle* calleth those only *Members* which are compounded of parts of diuers natures, as the Head, the Feete, and the Hands; and those that are similar he calleth properly *Parts*. *Theodorus* in *Aristotle*, thinketh that the name of a *Part* or *Place*, is of larger extent then the name of a *Member*. So also *Galen* in the sixt of his Method, sayth that the Eye may be called a Part or a Member; and the horny tunicle a Part, but not a Member: but because in these Philosophicall disquisitions, it becommeth vs better, to stand vpon substances, then vpon wordes; wee take no care whether you vse the name of a Part, a Member, a Particle, or a Place; it concernes vs more to find out an essentiall definition of a Part.

Hippocrates.

Aristotle.

Theodorus.

Galen.

Auicens definition of a part imperfect. *Fen prima primi. Doct. 5. ca. 1*

Auicen defineth a *Part to be a body ingendered of the first permixtion of the humours, as the humors doe consist of the first mixtion of the meate, and the meate of the Elements.* But this definition of the Arabian, is too presse, straight & narrow, because it agreeth only to homogenie parts, & not to heterogenie: for euery man may easily perceiue that heterogenie or dissimilar parts are compounded immediately of similar, not of the first mixture of the humors.

Galen.

And this *Galen* teacheth in plaine and expresse words, in his first Book *de Elementis*, where hee sayth; *that compounded partes are immediately made of the simple or similar, the simple of humors, humors of Aliments, Aliments of the Elements.*

An excuse of *Auicen* but which wil not hold water.

They which would salue the Arabians credite, say that his definition is materiall, not formall; for both similar and dissimilar do communicate in the matter, though their forme or difference be diuers; but they forget that an essentiall definition must expresse the forme especially, because it is the chiefe part of the essence, as that which giueth Being to the thing.

Aponensis definition of a part.

Aponensis defineth a part to be *a solid and thick body, begotten of humidities or moystures, and adorned with the powers of Nature*; which definition laboureth of the same disease with the former, comprehending onely simple not compounded parts.

Galens two definitions.

Galen hath two definitions of parts. The first, in the first Booke of his *Method* and the fift Chapter, and in the first booke *de Elementis*, cap. 6. The second is in his first Booke *de vsu partium*. The first is this; *A Part is that which accomplisheth or integrateth the whole*: Or *whatsoeuer addeth any thing to the frame of a humane body.* The second is this, *A Part is a body which neither hath a proper circumscription of his owne, nor yet is on euery hand ioyned with others.*

Both too large.

Both these definitions seeme to bee too large, comprehending not onely liuing particles (which are onely, truely and properly partes) but those also which haue no life, as the haires, the nailes, the fat. *Hippocrates* also vseth this large and ample signification of a part, in *Lib. 6. Epidemion*, where ἰσχόμενα καὶ ὁρμῶντα, that is, humors & spirits he calleth parts. So *Aristotle* calleth seede, bloud, milke, marrow, phlegme, and fatte, or grease, *Parts*.

Fernelius the french *Galen.*

Fernelius the french *Galen*, giueth vs a perfect definition of a Part, in the first Chapter of the second Booke of his *Physiologia*, and disputeth and scanneth the particular branches of his definition learnedly and at large.

Argenterius his cauil at *Fernelius.*

Argenterius (a common Calumniator sayeth *Laurentius*) taxeth *Fernelius* definition, assuming a diuerse consideration of mans body; first as it is a substance, and so hee sayeth the parts of it are the *Matter* and the *Forme*; next as it is a body, and so the parts of it are all the Corporeall substances therein contained. Finally, as a liuing and animated Creature, and in that respect (sayth he) whatsoeuer liueth, may be called a part of the liuing Creature, not a part of the body. Wherefore *Fernelius* did ill define a Part of mans body to bee *a body cohearing or cleauing to the whole, and ioyned to it in common life, framed for his vse and function.*

But these are but nice and friuolous cauils, and indeede extrauagant from a Physitians consideration: for a Phisitian doth not consider the body of man as it is a naturall body,

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consisting of matter and forme, but as it is obnoxious or liable to sickneſſe or health. And therefore *Fernelius* doeth well determine that thoſe bodies onely are to bee called partes, which may be the Subiects of sicknes and health. Now thoſe parts only are afflicted with diſeaſes, which performe ſome actions in the body, and actions belong to liuing parts, not to thoſe which haue no life. For ſicknes is an indiſpoſition which at the firſt hand and immediately hurteth or hindereth the action. And therfore *Fernelius* his definition is exquiſite and perfect, beſeeming a true Phyſitian.

Fernelius defended.

Of the principalitie of the Parts againſt the Peripateticks, proouing that there is not one onely Principall; to wit, the Heart. QVEST. II.

Concerning the principalitie of the partes, there is a famous difference betweene the Phyſitians and the Philoſophers. The great *Genius* and interpreter of Nature *Ariſtotle*, in the ſeauenth and the tenth Chapters of his ſecond booke *de partibus Animalium*; in the fourth Chapter of his third book *de partibus Animalium*; in his ſecond booke *de generatione Animalium*; in his booke *de vita & morte*; in his bookes *de ſomno*, and *de cauſa motus Animalium*, determineth that there is but one Soueraigne in mans body, and one Principle, which in his boſome and imbracement conteyneth and comprehendeth all the faculties. And this he reſolueth is the Heart, the fountaine (ſayth he) of the veines, arteries, and the ſinewes; the ſource of heate, ſpirits, and quickning Nectar, the firſt and onely ſtorehouſe of bloud, or worke-houſe of ſanguification; and finally, the ſeate and manſion houſe of the vegetatiue, ſenſatiue and reaſonable Soule. In *Ariſtotles* foot ſteps haue walked *Auerrhoes* in the ſecond of his *Collectanies*; *Aphrodiſeus* in his firſt booke *de Anima*, and many other both *Greeks* and *Arabians*: but they bring for confirmation of their opinion no neceſſary arguments, but ſuch onely as are probable, ſhadowed ouer with a veile of truth.

Ariſtotle wold haue but one principal part and that the heart.

It is more honourable (ſay they) and monarchical, that there ſhould be one principle then many; and that the very name of a principle doeth neceſſarily import ſo much. For if the ſoule of the Creature be but one in number, and that indiuiſible, then muſt the bodye likewiſe of it bee, either *one whole*, or at leaſt haue ſome one principall part; for eſſences muſt not be multiplied without neceſsity. And as in the great vniuerſe which we behold, there is one Principle, which *Ariſtotle* in his eighth booke of his *Phyſicks*, calleth *Primum mouens*, and *Primus motor*, that is, *the Firſt mouer*:

The argu-ments of the *Peripateticks*. The firſt.

Οὐκ ἀγαθὸν πολυκοιρανίη, εἷς κοίρανος ἔστω.

Ti's naught to haue moe Kings then one,
Let him that raygnes, raygne King alone.

So in the *Microcoſme* or Little world, there muſt be but one principle, one prince, which is the Heart, whoſe excellencie and dignity aboue the reſt of the partes, theſe things doe cleerely demonſtrate. Firſt, becauſe it firſt liueth, and dyeth the laſt; and therefore is the originall of life, and the ſeat of the ſoule. Next, becauſe it endureth no notable diſeaſe, but yeildeth preſently to Nature if it be afflicted. Againe, becauſe it obtaineth the moſt honourable place, that is, the middle of the body. Fourthly, for that by his perpetuall motion, all thinges are exhilerated and doe flouriſh: and nothing in the whole Creature is fruitfull, vnleſſe the powerfull vigour of the Heart do giue fœcundity vnto it. There (ſay they) is the manſion and Tribunall of the ſoule where heate is to be found, the firſt inſtrument of all the functions; but the Heart is the ſpringing fountaine of Natiue heate, which by the arteries as it were by ſmall riuerets, is deriued into the whole bodie. Moreouer, the ſeate of the faculties is there, where the Organs of the ſame faculties doe appeare; but all the veines, arteries, & ſinewes, doe ariſe out of the Heart. For the arteries no man euer made doubt. The veines doe ſurely ariſe thence, where their end and termination doeth appeare: but that is about the Heart; for the implantation of the great arterie and the hollow veine are alike. Beſide, all the veines are continuated with the heart, to it are they fixed, where they alſo haue membranes ſet like dores vnto them, which ſeeme to bee the beginnings and heads of the veines; but through the Liuer they are onely diſſeminated, and the reſt of the entralles they make a paſſage through, and ſo end into haire ſtrings. *Ariſtotle* alſo is of opinion, that the hart is the originall of the nerues; for his fleſh is hard, thight, and

The dignity of the heart.

The ſecond.

The third.

The heart the original of the veines.

The heart the original of the ſinewes.

Ariſtotle.

and ſomewhat membranous; but the ventricles thereof haue in them infinite textures of manifeſt ſinewes.

The 4. argument. The heart the firſt ſtore-houſe of bloud.

Finally, the Heart is the firſt αἱματοποιητικὸν, the firſt ζωϊκὸν and the firſt κινητικὸν καὶ αἰσθητικὸν that is, *Sanguifier*, *Liuer*, *Mouer*, & *Senſator*. That it is the firſt Sanguifier or the work-houſe wherein the bloud is made, the Philoſopher demonſtrateth; becauſe in it the bloud is contained as in a veſſell or conceptacle and receptacle; whereas in the Liuer it remayneth but as in a pipe or conuayance; and beſide, no where in the whole body is the bloud contained out of his veſſels, ſaue only in the Heart, which therefore is the Treaſurie thereof; and therefore in all ſudden paſsions of the minde, it returneth and flyeth to the heart as to his fountaine, not to the Liuer or to the Braine.

The heart the firſt ſenſator. The firſt reaſon.

That it is *primum ſenſorium*, the firſt ſenſator (that is,) that the faculties of ſence, motion and appetite, are deriued from the heart, the *Peripateticks* proue by theſe arguments. Becauſe in a *Syncope*, that is, a ſwounding where the vital ſpirits faile, there appeareth a ſodaine and head-ſtrong ruine and decay of all the faculties. Becauſe in all ſodaine motions of noyſome and hurtfull things, as alſo when we would auoide them, the heat of the heart being drawne inward, there appeareth a pale wanneſſe in the face; and on the contrary, when we conceiue ioy for any thing that is profitable, or when wee purſue ſuch things, the heate of the heart being called outward, there appeareth in the countenance a ruddineſſe and alacritie. Becauſe if the arteries called *Carotides* be tyed or obſtructed, then followeth preſently a ſenceleſſe dulnes, and a priuation of the Animality, if I may ſo ſpeake, the patient lying like a ſenceles ſtocke. Becauſe Ioy, Sorrow and Hope, are motions of the Heart, in which conſiſteth all the Appetite wee haue to purſue that which we like, or to flye and auoyde that we diſlike and abhorre. Finally, becauſe in ſleepe the Animall faculties doe reſt and ceaſe from their labours: now ſleep is nothing elſe but a retraction or calling backe of the heate to the heart from the other partes wherein it was in continuall expence; and that is the reaſon why a man after ſleepe is ſo much refreſhed, and riſeth ſtrong againe to the labour either of minde or body, albeit in both he were well wearied, yea tyred out before. As for the Braine (they ſay) it cannot be the authour of ſence, becauſe it is of a cold temper, vnapt for motion and made only to refrigerate and coole the exceeding heat of the Heart, being of it ſelfe without all ſence. Theſe and ſuch like are the arguments of the *Peripateticks*, by which they perſwade themſelues, that there is but one Principle of mans body, which is the Heart.

The ſecond.

The third.

The fourth.

The fift.

A confutation of the *Peripateticks*.

But theſe conceits of *Ariſtotle* and the Philoſophers, are long ſince hiſſed out of the Schooles of the Phyſitians, and baniſhed from amongſt them; becauſe they aſſume thoſe things for true which are vtterly falſe, and obtrude things probable as if they were neceſſary. And what I pray you is more abſurd, then to preferre the probability of a Logicall argumentation, before the euidence of ſence, reaſon, and experience, ioyned togither? Nowe that the veines doe ariſe from the Liuer, that the nerues or ſinewes which are ſoft and medullous or marrowy within, and without cloathed with membranes, are deriued from the ſubſtance of the Braine, he that hath but one eye may clearely diſcerne. That great Philoſopher obſerued in the heart many Fibrous ſtrings in both his ventricles, wouen out of the extremities of the ſmal membranes, and miſtooke them for threddy nerues; whereas indeede it hath but one ſmal nerue ariſing from the ſixt coniugation of the brain, which looſeth it ſelfe in his ſubſtance. Hee ſaw the hollow veine in the heart very large and ample; but he did not obſerue, that it onely openeth into the heart; (gaping at it with a ſpacious orifice or mouth, to poure into the right ventricle, as it were into a Ciſterne, ſufficient bloud for the generation of vital ſpirits to ſupply the expence of the whole body) but goeth not out of the heart; as doeth manifeſtly appeare, by thoſe three forked membranes, or values and floud-gates, yawning outward, but cloſe inward. But becauſe wee ſhall haue fitter occaſion hereafter to diſpute this queſtion with them, of the originall of the veines and the ſinewes, it ſhall bee ſufficient that we haue ſayd thus much of it at this time.

Demonſtratiue arguments to proue that the heart is neither the originall of the veines, nor of the ſinewes.

That the hart is not the beginning of animal motion

As for the ſeate of the faculties of ſence and motion, is it not againſt all reaſon and experience to place them in the heart? The heart indeede is moued, and that perpetually; but that motion is not Voluntarie but Naturall; it is moued, yet not at our pleaſure, but according to it owne inſtinct. Dayly practiſe and experience teacheth vs, that when the ventricles of the Braine, are either compreſſed, or filled and ſtuffed vp, as in the Apoplexy, Epilepſie, and drowſie *Cari*, then all the faculties are reſpited and ceaſe from their functi-

ons;

ons; but when the heart is offended, the life indeede is endangered, but neither motion nor sence intercepted.

Againe, if the heart were the seate of all the faculties, as the *Peripatetikes* would faine haue it, then vpon any affection of the same, or notable deprauation of his temperament, all the functions should be impeached; because all actions come from the Temper. But we see that in a *Hectique* ague or Consumption, wherein there is an vtter alienation of the temper (as being an equall distemper, of all distempers the most dangerous) yet the voluntary and principall faculties, do remaine inviolate. In the violent motions, and throbbing palpitations of the heart which (some say) haue beene seene so extreame that a rib hath beene broken therewith, yet neither the voluntary motions of the parts are depraued, nor the minde at all alienated or troubled. Who will deny, but that by pestilent and contagious vapors and breaths, comming from the byting of venomous beasts, or the taking of poyson, the vitall faculty is oppugned, and as it were besieged in his own fortresse? But yet those that are so affected, do enioy both sence and reason, euen to the last breath most times.

An elegant argument against the Peripateticks.

Strange motions of the Heart.

When the Braine is refrigerated, sleep presently stealeth vpon vs: now *Aristotle* himselfe defineth sleepe to be ἡρεμίαν τοῦ πρώτου αἰσθητικοῦ, *The rest of the first sensator*. If any of the principal Faculties, either Motiue or Sensatiue be affected, where do the remedies applyed auaile? Surely at the Head, not at the Heart. The Braine therefore, not the Heart is the first Moouer, and first Sensator. But the *Peripatetiks* obiect that the Braine hath no sence, and therefore cannot be the author of it. We will giue them a learned answere out of *Galen*, *The Braines sensation is not* παθητικῶς, *but* ἐνεργητικῶς, that is, not passiuely, but operatiuely. It receiueth not the species or Images of sensible things; but like a Iudge it taketh knowledge of their impressions, and accordingly determineth of them. They say, the Braine is vnapt for motion, because it is cold: we answere, it was necessary it should bee cold, that is, lesse hot, for the better performance of the functions. For if the Braine had exceeded in heate, then would his motions haue beene rash and vnruly, and his sensations giddie and fond as in a phrensie. In a *Syncope* the Animall faculties do faile. It is true, but why? Because there is an exolusion, and so a defect of vitall spirits, by which the animall are cherished. The Ligation or interception in like manner of the arteries of the necke, called *Carotides*, induceth a priuation of motion and sense, onely because the vitall Spirits are intercepted, which minister matter to the Animall.

Aristotle.

The sensation of the Braine not passiue but operatiue.

Why the braine is cold that is, lesse hot.

Answeres to the arguments of the Peripatetiks.

But one Principle is better then many. That we confesse is very true; but yet we know there are many reasons why it is not possible it should be so in this Little world. We will instance but in a few. It is granted by all men, that the substance of the arteries is diuerse from that of the veynes; and the substance of the sinnewes differing from them both; and as their substance, so is their structure very different, and their temper not one and the same: how then could it be, that Organs of so distinct kinds, should yssue all from one and the same part? Againe, it was necessary that these organes should in their originall be verylarge and ample to transfuse sufficient spirites, and a common matter suddenly and togetherward into the whole bodye. Now the magnitude or proportion of any one part, (much lesse of the heart) could not be sufficient for this purpose, either to affoord a foundation for so large vessels, or to supply a competent allowance of matter for them all. Adde heereto, that the faculties of the soule, follow the temper of the body, and therefore so diuers faculties might not issue from one part, which hath but one single temperament. How can we imagine reasonably, that three distinct & different faculties, yea oftentimes quite contrary, Reason, Anger and Concupiscence shoulde reside altogether, as if they were sworne friends in one Organ? Or how when the heart is on fire with anger, should reason make resistance, which delighteth in a middle and equall temper? Do not the vital and animall faculties require a different temper? Their Organs therefore must also necessarily be different and distinct. For the heart is by nature fitted to contain and propagate the vital faculty; but for the preseruation of the animall, it is vtterly incompetent. The reason is at hand. The vitall spirit is very hot, impetuous, raging, and in continuall motion, and therefore stood in neede of a strong organ wherein it should be wrought and contained, that the spirit might not becaus of his tenuity, be exhaled, nor the vessell by which it is conueyed, breake in perpetuall pulsing and palpitation; which both wold easily haue hapned, if the heart and arteries had bin thin, and of a slender texture. The animall faculty required another temper in her organ, otherwise the motions would haue beene su-

Why in the Little worlde there cannot be one onely principle.

The first demonstration.

The second.

The third.

The fourth.

rious, the ſences giddy and raſh; Reaſon would continually haue erred, becauſe the property of heate, is to confound and make a medley of all things, ſhuffling in one thing hudlingly vpon another, through his continuall and indefinent motion. And theſe are the arguments whereby the opinion of the *Peripateticks* is expulſed out of the Schoole of the Phyſitians.

How *Auicen* interpreteth *Ariſtotle.*

Auicen, Fen prima primi, doctrina quinta, cap. primo, interpreteth *Ariſtotles* opinion, playing the ſtickler in this manner. All the faculties (ſayth he) do reſide in the heart as in their firſt Root, but yet they Shine in the other members; that is, the Heart is the originall of diuers faculties, but vſeth the Braine as the inſtrument of ſence, ſo that *Radically* (that is his word) the Animall faculty is in the heart, but by *manifeſtation* in the braine.

The opinion of ſome later writers and their diuers diſtinctions.

Some againe intercede for the *Peripateticks*; and ſay, that the principal faculties motiue and ſenſatiue are in the heart, as in their originall and fountaine. That the rootes of the nerues are in the heart, but becauſe it is too narrow to yeelde out of it ſelfe all their propagations, they think the braine was framed as a ſecond principle, wherin the animall functions might, not obſcurely as in the heart, but euidently manifeſt and exhibite themſelues. And this power or faculty when the braine hath once receiued it from the heart, ſtandeth in no neede of continuall and immediate aſsiſtance therefrom, but onely of a ſupply after ſome time: Euen as the Commander of an Army, who hauing receiued his authority and his company from the Prince, ſtandeth in no farther neede of the Princes protection, vnleſſe it be now and then vpon eſpeciall ſeruices. They conclude therefore that the Braine and the Liuer are truely called principall parts; but this principality is but delegatory from the heart, no otherwayes then the Lieutenants of Princes, by them choſen for ſuch and ſuch imployments, doe receiue from them an order and power of diſpenſation and diſpoſition, whereby they are authorized, and ſo taken, as if they were immediate commaunders themſelues. Some others vſe another diſtinction, and ſay that materially the nerues proceede from the Braine and the veines from the Liuer; but the firſt and the formall principle they ſay is in the heart.

Comparison.

Scaligers opinion.

That Prince of humaine learning (at leaſt he that affected that ſoueraignty) *Iulius Ceſar Scaliger*, in the two hundred foureſcore and ninth Exerciſe of his booke *de ſubtilitate*, maketh many principles in the Heart. The firſt or primarie is τὸ ζωτικὸν or the liuing, the ſecõdarie τὸ κινητικὸν or the mouing principle; theſe do neuer ceaſe, neither are they hindred or intercepted in our ſleep or repoſe: yet are they not τὰ πρῶτα αἰσθητικὰ *tametſi* τῶν πρώτων αἰσθητικῶν that is, they are not *the firſt Senſators*, though they be of or from *the firſt Senſator*. Thus learned men labor to reconcile the *Peripateticks* & the Phyſitians. But they ſeem not to hold themſelues cloſe to *Ariſtotles* meaning: for hee doeth not thinke that in any ſence, the Braine can be ſayd to bee the author or original of Senſation, neither that the nerues doe ariſe from it. No where doth he attribute any delegatory power of Senſation vnto it; but thinketh it was onely made to refrigerate or coole the heat of the heart; whereas notwithſtanding all he can produce, it is the firſt principle of ſence and motion, neither receiueth any power for the performance of either of them from the Heart.

The late writers did not vnderſtand *Ariſtotle* well.

The opinion of the *Arabians* conſuted.

And whereas the *Arabians* ſay, that the Animall facultie is *Radicall* in the heart, and but by *Manifeſtation* in the braine; we can no way admit of that diſtinction: for if that faculty were in the heart as in the roote, then when the braine is obſtructed, the body ſhould not become ſenſeleſſe and without motion, becauſe there ſhould be a remainder both of ſenſe and motion in the roote, that is in the heart. But though the heart bee obſtructed, or the paſſages intercepted between it and the braine, yet there followeth not any ſodaine priuation of ſence and motion. Inſtances hereof wee haue in Sacrifices, where the Beaſt ſometimes hath beene heard to cry, and ſometimes alſo ſeene to runne a little way after his heart hath beene cut out: and we haue ſeene the ſame tryed in a Dogge, which ran crying a while after his heart was cut out, the veſſels ariſing from it vpward, being before bound.

Sacrifices run from the altar without their heart.

Galens elegãt demonſtratiõ.

Galen in his firſt booke *de Placitis*, illuſtrateth the whole matter, by an elegant demonſtration. If the Heart (ſayth he) did giue vnto the Braine the Animall faculty, then ſhould that power be deriued either by veines, arteries, or ſinewes; for there are no other veſſels which goe betweene them, and are common to them both. By veines or arteries, *Ariſtotle* himſelfe doth not thinke it is conuayed; beſide, theſe veſſels do not directly paſſe vnto the Braine, but after diuers contorſions and aberrations from a right & direct progreſſe. That it is not deriued by or through the nerues is manifeſt; becauſe, if the nerue which is diſſeminated through the ſubſtance of the Heart, be either diuided and cut aſunder or intercep-

ted,

ted, yet the Creature doth not presently fall, but onely groweth mute and dumbe.

It is therefore more consonant to right reason, that seeing the soule is but one and a simple substance, and wholly in the whole, and wholy in euery particle of the body; and therefore must necessarily haue the helpe of Organs, for the accomplishing of her seuerall functions: to assigne the seate of the faculty there where the Organs of those faculties are especially to be discerned. Wherefore seeing the *Peripateticks* doe confesse, that the Organs of sence and motion are more conspicuous in the Braine then in the heart: why will they not yeeld to the Physitian, that the Animall faculty is in the braine, the Vitall in the Heart, and the Naturall in the Liuer; but make all the worlde witnesses of their refractarie mindes, then which in a true Philosopher nothing is more illiberall? Howsoeuer, to conclude, we subscribe to the opinion of the Physitians, who haue banished this Vnitie of Principles out of their Schooles. The conclusion of the whole disputation.

QVEST. III. *How many principall parts there are.*

BY those things which we haue thus at large discoursed, it is manifest to all men, that there is not one, but many principall parts of mans body; it remaineth that we shew you now how many there are. The number wee cannot better aportion, then from the nature and definition of a Principle. First therefore, we must make it appeare (because Physitians heerein doe not agree) what a principall part is.

Galen in his Booke *de vsu partium*, defineth this principality by Necessity. That is a Principall part, which is of absolute necessity for the life of Man. I will shew you (saith he) by what markes you shall know a principall part, to wit, by the profit it bringes; now the profit of a part is threefold, either it is simply for life, or for better life, or else for the preseruation of them both; and all such parts without doubt, are truly principall. And in the first Chapter of the xiiii. Booke *de vsu partium*; Nature hath a three-folde scope in the structure of the parts of Mans body. The first is of those which are necessary for life; and such parts are called Principall, as the Braine, the Heart, and the Liuer, &c. We wil therfore define a Principall part to be *that which is absolutely necessary for the preseruation of the whole indiuiduum or particular Man.* What a principall part is. *Galen.* The first definition of principality.

Argenterius, who in a humor of contradicting *Galen*, opposeth himselfe vnto him, reiecteth this definition; because if a principall part be defined by necessity, the Stomacke, the Loynes, the Spleene, the Bladder and the Kidneyes, will all fall into the reckoning of principall parts. For the action of the Stomacke, is necessarie also for life. The motion of the Lunges we cannot misse, no not for a moment of time; the interception of the Vrine is mortall; and therefore the excretion or auoyding thereof, which is accomplished by the Kidneyes and the Bladder is necessary. But he seemeth to me not to haue attained to the thorough vnderstanding of *Galens* mind: for there is a double necessity of the parts, one absolute for the preseruation of the *indiuiduum*, another not ἁπλῶς, that is, simply and absolutely, but *secundum quid*, or hauing reference to the former. The first maketh a part principall, as the Braine, the Heart, and the Liuer: the second kinde of necessity is but relatiue or collaterall, by which some parts owe obseruance to the principall, as necessary seruitors vnto them. For example: What necessary and immediate offices do the Lungs, the Kidneyes, the Bladder, and the Spleene performe to the arme, the legge, or the stomacke? But the heart giueth them life, the Liuer affoordeth nourishment, and the Braine supplieth them with sence and motion. *Argenterius* his vaine opposition to *Galen.* *Argenterius* answered. A double necessity of the parts.

This may seeme somewhat obscure to those that are but Catechists in our Art, but by examples we shall make it sufficiently perspicuous. The Liuer is the onely Prince in the lower region or belly, being therein alone absolutely necessary, and at his owne cost, nourishing the whole family of the body; all the other parts within his precinct are made for his vse. The stomack as a seruant ministreth meate vnto him, the bladder of Gaul purgeth away the Choller from that meate, the Spleene drayneth away the Melancholy iuice, and the Kidneyes the serous or whayie humor, all concurring to depure and cleanse it from excrements to his hand. If therefore they be necessary, it is not for the preseruation of the whole Man, but because they be necessary Ministers to assist the Liuer in his worke. Againe, the Heart sitteth in the middle Region as in his pallace, the Lungs, the Midriffe, and all the arteries attending him for his vse, whom he employeth in quickning the whole body; the How the other partes serue the principall, & in that regard are necessary

the ſame may be ſaide of the braine. Wherefore the braine, the heart, and the liuer, are onely principall parts, becauſe they alone are immediately and abſolutely neceſſary for the preſeruation of euery particular creature. *Galen* alſo anſwereth this cauill another way, on this manner. The action of the ſtomacke is not abſolutely neceſſary, but only for the continuance and prorogation of life. Witneſſe thoſe Creatures which mew themſelues vp all Winter, neuer eating, and ſo not vſing the action of the ſtomacke, albeit they liue nathleſſe. Furthermore, nouriſhing Cliſters do not aſcend vnto the ſtomacke, yet they are ſucked by the Meſeraick Veynes, and tranſported vnto the Liuer, and ſo ſuſtaine the body, as may be inſtanced in that malefactor, who after hee was taken from the Gallow, was found to be aliue, and a good while ſuſtained by ſuch Cliſters, when it was not poſſible to get any thing into his ſtomacke. A Creature therefore may for a time liue without Chilification, which is the action of the ſtomacke, but not without ſanguification, ſayth *Galen*, which is the proper function of the Liuer.

Galens anſwer to the former cauill.

A Storie of a Malefactor.

Sexto de placitis.

That which is obtruded concerning the Lunges, is of no moment; for they worke rather for the commodity of the heart, then for the immediate maintenance of life. The hart might ſatisfie it ſelfe with aire attracted through the rough and ſmooth Arteries; but leaſt the outward impurity thereof ſuddenly ruſhing into the Ventricles ſhold offend it, Nature hath cautelouſly ſet the Lunges betweene them, as a ſhop wherein the aire is broken and dulcified before it come vnto the heart. And thus much may ſuffice to ſatisfie the former obiection, and to euince that onely thoſe partes are principall, which are abſolutely and immediately neceſſary for the preſeruation of life.

How the Lunges ſerue the Heart.

But there are others which oppoſe *Galen* to *Galen*, who in his firſt Chapter of his firſt Booke *de Locis Affectis*, affirmeth, that the heart onely is abſolutely neceſſary for the life of the creature: his words are theſe, *If the Creature bee neither nouriſhed, nor haue ſence or motion (which hapneth in ſuch as lye within the earth) yet may it liue as long as the heart is not violated; but if the heart be defrauded of reſpiration, the Creature inſtantly periſheth.* To this we anſwere: That in bloody and perfect creatures, the action of the braine and the Liuer, is abſolutely neceſſary; but thoſe creatures which liue ſo mewed vp in winter, are vnbloudy or without bloud, although it cannot be denied, that hyſtericall women, that is, ſuch as haue violent fits of the Mother, do liue ſome good ſpace without breathing, as we could inſtance in many, if it were not ſo ordinary, as that no man will deny it.

An obiection againſt *Galen*.

Galen.

The anſwere to the obiection.

There is alſo another very elegant definition of a Principle, in the tenth Chapter of *Galens* ſixt booke *de Placitis*, in theſe words; *That is called a Principal part, which alloweth or affoordeth to the whole, either ſome faculty, or at leaſt ſome matter.* According to this definition alſo, there will be three principall parts. For that the Braine doth tranſmit the Animall faculty, and the Heart the Vitall, will be eaſily yeelded vnto vs. All the ſcruple is about the Liuer, becauſe it ſeemeth not reaſonable, that it ſhould affoord to the particular parts, a naturall influent faculty, ſeeing euery part hath ſuch an one bred, and ſeated in it ſelfe. For the time we let paſſe that Controuerſie, it is ſufficient for our preſent purpoſe, to prooue it a principall part, though it yeeld no faculty, if it yeeld a matter to the vvhole body, which no man in his right wits but will eaſily confeſſe, or let him but pricke his finger and he ſhall ſee it. *Auicen Fen prima, doctrina 5. Capiprimo*, defines that to be a principal part, which hath in it ſelfe the Originall or beginning of the firſt and chiefe faculties of the body; or wherein the power or efficacy of thoſe faculties, by which the body is diſperſed or gouerned, doth as in his chiefe ſeate eſpecially reſide and manifeſt it ſelfe. Some of the late Writers haue defined a principall part to bee that, which out of it ſelfe exhibiteth and communicateth to other parts, ſome actiue Inſtrument; as for inſtance, a Spirit. So that which of all theſe definitions we accept of, it will ſtill remaine that there are three principall parts, the Braine, the Heart, and the Liuer. For if we reſpect Neceſsity, theſe only are abſolutely neceſſary; if the originall of the faculties, in the Braine reſideth and ſhineth the animall, the vitall in the heart, and the naturall in the Liuer; if the Inſtruments, then from the Braine floweth the animall ſpirits by the ſinnewes, the vitall from the heart by the arteries, the naturall from the Liuer by the veins; and by thoſe paſſages are all diffuſed from their fountaines in the whole body.

Another definition of a part.

Auicens definition of a principall part.

A definition of the late writers.

Galen in his Booke *de Arte parua*, addeth to the principall partes a fourth, to wit, the Teſticles: not in reſpect to the *indiuiduum* or particular creature; but becauſe they are of abſolute neceſsity for the conſeruation of the kinde, and production of encreaſe. For the Teſticles indeede do not make allowance to the whole body of any matter, or facultie, or

ſpirit,

ſpirit, but only of a quality, together with a ſubtile and thin breath or aire, from which the fleſh hath a ranke taſte of the ſeede, and the bodye a ſtrength or farther ability in the performance of his actions.

QVEST. IIII. *Which of all the principall Parts is the moſt Noble.*

HAuing præmiſed this diſputation concerning the number of the principall parts, it remaineth (becauſe wee would haue nothing wanting which may giue ſatisfaction to ſuch as deſire it) that we inquire which of all the principall parts is worthily to be preferred aboue the reſt. *Galen* in his firſt Booke *de ſemine*, preferreth the teſticles to the heart; where he ſaith, *The Heart is indeede the author of liuing; but the Teſticles are they which adde a betterneſſe or farther degree of perfection to the life*, becauſe if they be taken away, the iollity and courage of the Creature is extinguiſhed; the Male followeth not his Female, the Veynes looſe their latitude, and become ſunke & narrow; the Pulſe abateth of his ſtrength, and becomes weake, dull, and languiſhing; the skin is pilde and bare, whereupon ſuch men are called *Glabriones*; and in a word, all virility or manhoode vaniſheth away. *Galen* addeth. The Teſticles are another Fountaine or Well-ſpring of in-bred heate; the Feu-place or Fire-hearth, where the *Lares* or houſhold-Gods of the body, do ſolace and diſport themſelues: from hence the whole body receyueth an encreaſe of heate, and by that meanes not onely fœcundity, but alſo a great alteration of the temper, the habite, the proper ſubſtance, yea and of the manners themſelues: ſo that to ſay true, their power is very great, and almoſt incredible, then eſpecially knowne when it is wanting, as we may obſerue in Eunuches.

Galen preferreth the Teſticles before the Heart.

Glabriones. Galen.

Wherein the Teſticles do ſhew their power.

Wherefore as to be and liue well, is more excellent then ſimply to liue and haue an Idle and ſluggiſh exiſtence, ſo the Inſtrument of the former which is the Teſticles, is more excellent then that of the latter, which is the heart. A probable but a ſophiſticall argument. True it is, that which giueth better life, if it giue life alſo, is more excellent then that which giueth life onely: but the teſticles do not giue life at all, the creature can liue without them; they adde indeed a perfection, not to life, that is, to the concreate as we ſay, but to liuing, that is, to the abſtract; ſo do the eyes, ſo do other parts, without which a Man ſhould liue, but in liuing ſhould be miſerable: the heart therefore giueth the ſubſtance, the teſticles exhibite but an additament, which may be away, albeit it bee with notable detriment; detriment I ſay, not of that which the heart giueth, which is the ſubſtance; but of that which themſelues affoord, which is a complement. Now that a ſubſtance is of more excellence then a complement no Man will deny, the heart therefore is more noble then the teſticles. But the heart hath a greater concurrent in this plea of honour, which is the braine.

Galens ſubtile argument anſwered.

Whether the Braine be to be preferd before the hart.

The *Peripatetikes* and *Ariſtotle* their Prince, together with the whole family almoſt of the *Stoickes*, eſpecially *Chryſippus*, do giue the preheminence to the heart, as well becauſe it is ſeated in the middeſt, which is the place of honour; as alſo becauſe it is a liuing and abundant Fountaine of Natiue heate; and finally, becauſe it is the ſpeciall habitation of the ſoule; for euen *Hippocrates* himſelfe, the Oracle of Phyſicke, in his booke *de Corde*, placeth the ſoule in the left ventricle of the heart; and hence it is, that they call the heart καρδίαν, *quaſi* κρατίαν: for κράτος ſignifieth Empire or rule comming from κρατέω *to Command.*

The opinion of the *Peripatetiks & Stoiks*

Hippocrates.

But all this notwithſtanding, we are enforced to yeelde the ſuperiority to the braine, becauſe his functions are more diuine and more noble then thoſe of the heart. For example: All ſence and voluntary motion proceede from it, the habitation it is of Wiſedome, the Shrine of Memory, Iudgement and Diſcourſe, which are the prerogatiues of Man aboue all other Creatures. This is the Prince of the Family, and the head is the head of the tribe, all other parts are but attendants (though ſome ſerue in more honourable place then others,) and owe homage vnto it, yea all were created onely for his vſe and behoofe. For the braine being the ſeate of the intelligible or vnderſtanding faculty, it was requiſite firſt, that it ſhould be ſupplied with phantaſmes or repreſentations; theſe repreſentations could not be exhibited and repreſented to the vnderſtanding, but by the miniſterie of the outward ſences. For it is a rule in Philoſophy, *Nihil eſt in intellectu quod nõ prius fuit in ſenſu. There is nothing in the vnderſtanding or intellect, which is not firſt in the ſence.* It was neceſſary therefore, that the ſences ſhould be created for the intellect. Furthermore, the

We determin that the brain is the prime principal part

An Elegant demonſtratiõ how all the body is ſeruiceable to the Braine.

ſences

ſences could not haue beene perfect vnleſſe the Creature could haue moued locally to gather his phantaſmes out of diuers obiects, as the Bee flyeth from one flower to another to gather hony; and therefore Nature ordained the organs or inſtruments of motion, the muſcles, the tendons, and the nerues. Theſe (vnleſſe wee ſhould haue crawled vppon the earth like wormes) did neceſſarily require props and ſupporters to confirme and eſtabliſh them, whereupon the bones and the griſtles were ordained; and ligaments alſo to knit and ſwathe them together: now all of them ſtand in neede of perpetuall influence, of heate to quicken them, and of nouriſhment to ſuſtaine them; both which are ſupplied, the former from the Heart by the arteries, the latter from the Liuer by the veines: ſo that truth to ſay, there was no other end of the Creation of all the parts and powers of the body, but onely for the vſe and behoofe of the Braine.

Obiection. Anſwere.

It will be obiected, that the braine cannot accompliſh his functions without the ſpirits of the heart, and the influence of his heate; I anſwere, that that is an inuincible argument of the ſoueraignty of the Brain; for the end for which a thing is ordained, is more noble then the thing ordained for that end; the life therefore and the heart are but handmaids to the Braine. We will adde alſo this argument, which happely will ſeeme not incompetent: The Braine giueth figure vnto the whole body; for the head was made onely for the Brayne; now *Hippocrates* ſayth that the nature of all the reſt of the bones dependeth vpon the magnitude of the head: not that all the bones deriue their originall from the head; but becauſe it behooued that they ſhould bee all proportionably anſwerable to the bones to which they are articulated, as the legges to the thighes, the thighes to the haunches, the haunches to the holy bone, the holy bone to the ſpondles or racke bones, the racke bones to the marrow of the backe, and that to the braine.

Hippocrates.

The former arguments of the *Peripatecticks & Stoicks* anſwered.

For ſatisfaction to the arguments before vrged by the *Peripatetians* and the *Stoicks*, we ſay. That the *Etymon* or deriuation of the name of the heart, is but friuolous & not worthy the ſtanding vpon. For the ſcite of the heart in the middeſt, it doeth weigh *tantundem*, as much as nothing; neither indeede is the ground of it true: for of the whole body the nauel is the Center; and for the trunke or bulke, who euer ſaid (that was an Anatomiſt) the heart was in the middeſt of it? But if wee will draw an argument of dignity from the ſcituation, then will the true ſuperiority fall to the Braine, becauſe it is placed vppermoſt, as the fire aboue the inferiour elements; the higheſt heauen the ſeate of the bleſſed ſoules aboue the ſubiected orbes; for to be placed aboue, is high ſuperiority and præeminence; to be thruſt downe below, betokeneth baſe ſubiection and inferiority. As for that place of *Hippocrates*, where he placeth the ſoule in the left ventricle of the heart, either he ſpeaketh to the capacity of the vulgar, or elſe by the ſoule he meaneth the heate, as happely wee ſhall haue more occaſion to ſhew hereafter. We conclude therefore, that of the principall parts, the first place belongeth to the Braine, the next to the Heart, the laſt to the Liuer. Againe, in the *Oeconomie* or order of the parts, this rule is obſerued; that thoſe which are firſt in order of nature, are laſt in dignity and excellencie: ſo the Infant firſt liueth the life of a plant, then like a beaſt it mooueth and becommeth ſenſible; finally, it receiueth it's perfection when it is indued with the reaſonable ſoule; as hauing then the laſt hand and conſummation from the Creator, when he ſetteth his ſtampe or image vpon it.

The argument retorted.

Expoſition of *Hippocrates.*

A rule in the diſpoſition of the parts.

Galen in the laſt Chapter of the ſeauenth booke of his Method, compareth the dignity and neceſsity of the three principall parts one with another in theſe wordes. *The dignity of the Heart is very great, and in ſicke patients his action and the ſtrength of it, of abſolute neceſſity; the Brayne is of equall moment for the preſeruation of life, yet the ſtrength of his actions is not ſo immediately neceſſary in thoſe that are diſeaſed for their recouery: the action of the Liuer is as neceſſary as eyther of them for the maintenance of the particular parts, but yet for preſent & immediate ſuſtentation of life, it is not ſo inſtantly neceſſary as both the former.* To conclude this queſtion, there is a threefold principle; one of Beginning, another of Dignity, a third of Neceſsity. The *parenchyma* or fleſh of the Liuer is the originall principle; the Braine is the moſt noble principle; and the Heart of moſt neceſsity; yet they all haue ſuch a mutuall connexion and conſpiration, that each needeth others aſsiſtance, and if one of them decay the reſt doe forthwith periſh. Euen as in a wel gouerned Citty or Common-wealth there is a wiſe Senate to guide it, a ſtout and valorous ſtrength of ſouldiours to defend and redeeme it; and an infinite multiplicity of trades and occupations to maintaine and ſupport it; all which though they be diſtinguiſhed in offices and place, doe yet conſent in one, and conſpire together for their mutuall preſeruation. And this conſpiration *Galen* expreſſeth

Galen.

A conference of the dignity & neceſsity of the principal parts.

The deciſion of the whole queſtion.

A three fold principle.

Compariſon.

Galen.

to

to the life, in his booke *de formatione fœtus*, and the fift chap. thus: *When the Heart is depriued of respiration it ceaseth to moue, & immediately death ensueth; now it is depriued of respiration when the nerues (which come from the Brayne) are either cut, or obstructed, or intercepted.* As therefore the Heart needeth the helpe of the Braine, and being forsaken by it, maketh a diuorce betweene the soule and the body; so it also maketh retribution to the Brain, supplying it with spirits of life, out of which the Animall spirits of the Braine are extracted; and the Liuer though it lye below, yet it yeeldeth matter to them both, wherof and whereby their spirits are made and sustained. The mutual conspiration of the principal parts.

But against this doctrine of the consent of these principall parts, there is a notable place of *Galens*, in the fourth chapter of his second booke *de placitis*, which needeth to bee cleared before we fall from this discourse; for hee sayeth: *As Pulsation and voluntary motion belong to diuers kindes of motion; so neyther of those principles needeth the helpe one of another.* Which place we interpret thus: that the hart doth not transmit the Animal faculty to the braine, nor the braine the faculty of Pulsation to the heart, because the temper and formes of the faculties are diuers; and therefore the heart conferreth nothing to the *Idea* or forme of voluntarie motion, neither the braine to the power of pulsation; yet hence it must not be inferred, that the braine needeth not the help of the heart, or on the contrary the heart of the braine: and thus much of the definition, and number, and precedency of the principarts. Obiection. *Galen.* A hard place in *Galen* expounded.

QVEST. V. *Of similar and dissimilar parts, and first of the number of them.*

THE nature and number of the Similar parts because they are much controuerted, we will examine for their sakes, who are not so well exercised in these schoole poynts; that if they be not able to draw out of the fountaines themselues, they may dip their vessels in this shallow foord of ours, to satisfie their thirsty minds.

Some there bee that contend, that there are no similar parts at all, because the most simple are not voide of composition; and they alledge *Galens* authority for it; who in the eight chapter of his first booke *de Elementis*, sayth: *That the simple parts are made of humors, humors of Aliments, Aliments of Elements.* And in his first booke *de semine. All parts are generated of seede and bloud.* But the answere to this is easie and obuious; for parts are called similar, not because they are exquisitly simple and incompounded, but because they cannot bee diuided into *Parts* of diuers kindes, neither yet are compounded of any other *Parts*, though of diuers substances. So the Philosopher calleth the Elements simple bodies, because they are not compounded of other *bodies*, although they consist of matter and forme. Yea the very soule of man is not in this sence truely simple, nor yet the Angelicall substance; for if they were, they should be impatible: and indeede nothing is truely simple but God himselfe; but we of purpose giue ouer this mysterie before wee enter into it, because euery one is not a fit auditor of this kinde of Philosophy. The number of the similar particles concerneth vs at this time more, wherein there is great heate and contention of opinions. *Galen* in his commentaries vppon *Hippocrates* booke *de natura hominis* numbreth seauen: *Bones, Gristles, Ligaments, Membranes, Fibres, Fat* and *Flesh.* And whereas there is a threefold kind of flesh, one of the muskles, which is indeed true flesh; another of the entrals which is called παρέγχυμα, and the last of the particular parts; he accounteth them all similar, for so he speaketh in the sixt chapter of his first booke *de naturalibus facultatibus. Among the similar partes are to bee accounted the flesh of the Liuer, the Spleene, the Kidneyes, the Lungs, and the Heart; as also the Coates of the Stomacke and the Guts, and the proper body of the Braine.* For if from all of these you shall exempt or take away, either really or in your imagination, the veines, the arteries, and the nerues; the body which remayneth will be simple and elementary. In the sixt chapter of the first booke *de Elementis*, he addeth to the former seauen, *Sinewes, Marrow, Nayles* and *Haire.* In his booke *de inæquali intemperie*, *Tendons* and *Skin.* In his booke *de differentijs morborum*: and in the second booke *de Elementis*, he addeth *Veines* and *Arteries.* So that according to *Galen* in the places alleadged, if wee summe vp the similar parts, they will arise to foureteene: Bones, Gristles, Ligaments, Membranes, Fibres, Nerues, Arteries, Veines, Flesh, Skin, Fatte, Marrow, Nailes and Haires. That there are no similar parts. *Galen.* Obiection. Answere. Why similar parts are so called. The soule of man is not simple. The number of the similar parts. *Galen.* A three-fold kinde of flesh. *Galen.* *Galen.* 14 Similar parts after *Galen.*

Many

Galen accused

Many accuse *Galen* of leuitie and forgetfulnesse, because in diuers places hee calleth veines, arteries, and nerues similar parts; & yet in his booke *de inæquali intemperie*, hee accounteth them dissimilar and organicall. *Argenterius* answeres for him; that in a similar part, he hath a double respect to their matter and their form; and wheras he calleth nerues, veines, and arteries, similar bodies, he doth it with respect to their matter, which is simple and vniforme; where he calleth them organicall, he hath respect to their forme and figure, which is round and more or lesse hollow: but *Argenterius* by this answere, rather betrayeth then redeemeth his maister: for the matter of the veines, nerues, and arteries, is not vniforme. *Galen* in his booke *de placitis*, and *de vsu partium*, teacheth that nerues are withinward, soft and marrowy; outward, membranous; as also the bodyes of arteryes are wouen of membranes and fibres.

Argenterius answere for *Galen* insufficient.

Galen.

The common answere for *Galen* approoued.

The common answere for *Galen* approoued. Obiection.

The common answere for *Galen* approoued. Obiection. *Galen.*

The common answere for *Galen* approoued. Obiection. *Galen.* *Montanus* answere to the Obiection.

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The common answere for *Galen* approoued. Obiection. *Galen.* *Montanus* answere to the Obiection. Obiection. Solution.

The common answere for *Galen* approoued. Obiection. *Galen.* *Montanus* answere to the Obiection. Obiection. Solution. A similar part may also be said to be Organicall.

Fernelius.

Aristotle.

A twofolde consideration of an organicall part.

The common answere for *Galen* approoued. Obiection. *Galen.* *Montanus* answere to the Obiection. Obiection. Solution. A similar part may also be said to be Organicall. *Fernelius.* *Aristotle.* A twofolde consideration of an organicall part. of

of them a manifeſt organicall action; the one diſtributing and diſperſing the blood, the other accompliſhing voluntary motion. But that theſe things may be more manifeſt, and deſcend deeper into the capacity of thoſe that are but initiated, it ſhall not be amiſs to recal them againe to the ballance, and weigh them ouer more preciſely.

Galens definition of an organ Another.

Galen in the ſixt Chapter of the firſt Booke of his Method, and in his Booke *de inæquali intemperie*, defineth an Organ to be *that part of the creature which can perform a perfect, that is, a proper action*. More fully it may be defined thus. *A Part which onely produceth an action proper and peculiar to it ſelfe*; ſo a Muſcle and an Eye may be called Organes, becauſe only the Muſcle mooueth, the Eye onely ſeeth. As for the ſimilar parts, their action is perfect indeede, but common, not proper or peculiar to themſelues, to wit, Nutrition; & therefore they cannot properly be called Organs. Now that nutrition is a ſimilar, and not Organicall act ō, it appeareth by both their definitions. That action is ſaid to be ſimilar, which is commenced or begun onely by the temper of the part, and by the ſame perfected, and is beſide wholly and perfectly wrought by the leaſt portion of the part, as well as by the whol. That Nutrition is of that nature, it is ſo manifeſt, as it needeth no demonſtration; for euery part or portion of a Bone, draweth, retaineth, boyleth the Aliment; and beſide expelleth that which is ſuperfluous; the reaſon is, becauſe euery part of a bone is a bone, and hath the forme and nature of the whole bone: this forme is called *temperies* or the temper, wherfore onely from the temper proceedeth the original and perfection of nutrition. Againe, *Fleſh* (as *Galen* ſaith in the 9. Chapter of the firſt booke *de vſu partium*) *is fleſh onely through his temper, and a Nerue is a Nerue by his temper*. And in the firſt booke *de Naturalibus facultatibus*, *He that endeuoureth to preſerue the action of the ſimilar parts, it is neceſſary that he preſerue their temper*. So that it is manifeſt, that Nutrition accordeth with the definition of a ſimilar action. Now how repugnant it is to the definition of an organicall action, it remaineth that we ſhew. That is called an organicall action, which neither is begun, nor abſolued or perfected by the temper alone, but requireth to his integrity and perfection the whole inſtrument. So viſion which is the proper action of the eye, is not accompliſhed by the Chriſtalline humour alone, nor alone by the opticke nerue, or the coates of the eye, but by all togither. Neyther is the forme of this organicall action the temper, but the laudable conformation of the whole inſtrument. The eye ſeeth not, the hand handleth not, the foote goeth not forwarde, the muskle mooueth not onely by the temper; but becauſe the organs are thus or thus diſpoſed or framed.

What is a ſimilar action.

The forme of a ſimilar part is his temper. *Galen.*

What is an organical action.

Whether the action do proceed from the ſimilar parts.

Here ſome ouertaken with irreſolution, becauſe of the obſcurity of the queſtion, doe ſweate and contend to proue, that all actions belong to the ſimilar parts and proceed from them, none from the organicall. And they alledge the authority of *Galen* for their warrant; who in the ſecond chapter of the ſeauenth booke of his Method, and the third chapter of the ſixt booke *de locis affectis*, and in his booke *de optimo corporis habitu*; ſayth, *That in euery organ there is one particle ſimilar, which is the principall cauſe of the organicall action, and that the reſt are onely aſſiſtant, conferring ſome vſe but no action*. So viſion proceedeth from the Chriſtalline humour, ſanguification from the *parenchyma* of the Liuer, voluntary motion from the fleſh of the muskle; but the coates of the eye, the muskles, the nerues, the two humours, doe eyther make the ſight more perfect, or onely conſerue it. Moreouer, in the fift chapter of his booke *de conſtitutione artis*; hee writeth *that the actions are primarily and per ſe*, that is, *of it ſelfe, from the ſimilar part; and ſecondarily and by accident, from the organical*. Adde hereto that the functions doe flowe from the faculties, the faculties from the temperament; now the temper is the forme of the ſimilar part, not of the organicall: and in the fift booke *de locis affectis*, he ſayth: *That the very eſſence of al the faculties doeth conſiſt in the temper*. In the ſixt booke *de locis affectis*: he ſayth, *that the actions doe flowe from the proper and peculiar eſſence of the parts not from the poſition: for if the Heart or the Lyuer ſhould change their place, yet would they performe the actions they doe in the places wherin now they are*. And in the tenth booke of his Method, ſpeaking of a cold bath: *Thoſe that are Hectical*, that is, *in a conſuming and lingring ague, are eaſily offended by the occurſion or touch of cold water or ayer, becauſe theyr ſolid and ſimilar parts*, (they being more neare the threds) *are bare and naked, by which all the actions of lyuing creatures are performed*. *Ariſtotle* alſo is of opinion that all ſence commeth from the ſimilar parts.

Authorities of *Galen* to proue that they do.

Ariſtotle.

The explication of the queſtion, wherin *Galen* is interpreted

This their deuice I muſt needs ſay is probable, but yet they trouble the pure fountain of *Galens* Philoſophy. It is true that he acknowledgeth in euery perfect organ one ſimilar particle, which is the principall cauſe of the action, but yet hee neuer meant to referre the

cauſe of the perfect action onely to the temper of that particle: ſo hee acknowledgeth the temper of the Chriſtalline humor, to be the efficient cauſe of viſion or ſight, together with his purity, ſmoothneſſe, and ſcituation, which are all organicall. For if the poſition of the Chriſtalline humor be changed, if it be drowned too deep in the glaſſy humour, although the temper of it remaine neuerſo exquiſite, yet the viſion cannot bee perfect. In a word therefore I anſwere, that the originall of the action dependeth vpon the ſimilar part and his temper, but the perfection of the action followeth the frame of the whole organ. And this *Galen* teacheth in the ſixt chapter of his book *de differentijs morborum*, and in his book *de optima corporis conſtitutione*, where he willeth and reſolueth, *that the actions doe firſt of all and originally, iſſue from the ſimilar particles, but their accompliſhment and perfection dependeth vpon the frame of the whole organ.*

What we muſt reſolue vpon according to *Galen.*

Whether the Spermaticall parts be generated of ſeede.

QVEST. VII.

HAuing thus handled the diſtinction of the parts, & the natures of them all; it remayneth that we entreat of thoſe parts which are called Spermaticall. concerning which, there are three queſtions among the reſt moſt notable: Whether they be immediately made of the ſeede; whether they can grow together againe or bee reſtored; and whether they bee hotter then the ſanguine or bloudy parts or no; all which we will diſpute in order. The firſt queſtion is hard to be determined, and therefore we muſt be conſtrayned to take our riſe a little higher, for that the nature of ſeede which is intangled in many folds of difficulties, muſt firſt be vnfolded: notwithſtanding, becauſe wee ſhall haue fitter oportunity in the booke of the generation of man, to ſearch more narrowly into the myſteries of this ſecret, wee will content our ſelues in this place briefly to run ouer thoſe things which ſhal moſt concerne the matter we haue in hand.

Three queſtions concerning ſpermatical parts.

The firſt queſtion.

It is agreed vpon betweene the Phyſitians and the *Peripatecians*, that ſeede is a Principle of generation. But the Philoſophers doe acknowledge it onely to be a formall and efficient Principle, the Phyſitians both a formall and a materiall; formall, by reaſon of his ſpirits; materiall by reaſon of his body. The Phyſitians therefore doe determine, that the ſpermaticall parts are generated out of the craſſament or thicke ſubſtance of the ſeede, the *Peripateticks*, onely out of the bloud. This latter opinion is not without his patrons and abettors, and beſide, ſupporteth it ſelfe by theſe arguments. If the Spermaticall parts were made of the ſeede as of a materiall principle: then the actiue and the paſsiue, the act and the power; the mouer and that which is moued; the matter and the forme; the maker and the thing made ſhould be the ſame; which true and ſolid Philoſophy will not admit. Againe, according to *Ariſtotle* in the ſecond booke of his Phyſickes; the Artizane is neuer a part of his owne workmanſhip; the ſeede is the artizane. *Galen* calleth it *Phidias*, who was an excellent Statuarie, and made among other peeces *Mineruas* ſtatue of Iuory 26. cubits high &c. And in the 20. chapter of the firſt book *de generatione Animalium*; *The ſeed is no part of the Infant that is made*, ſayth the Philoſopher; no more then the Carpenter is a part of the woode which hee heweth: neyther is there any part of the art of the artificer in that which is effected; but onely by his labour through motion, there ariſeth in the matter a forme and a ſhape. Moreouer, it is an axiome of Phyſicke, *That wee are nouriſhed by thoſe things whereof we are formed, framed, and do conſiſt*; but all the parts of man are nouriſhed with blood, and therefore they are all generated of blood alſo.

The P*eripatetick*s thinke that all the parts are generated of bloud.

The firſt reaſon.

The ſecond. *Ariſtotle.* *Phidias* the Statuary.

An axiome in Phiſicke.

The third.

Furthermore, if the principall parts, the Heart and the Liuer bee made of blood (for their ſubſtance is fleſhy, and *Hippocrates* calleth them both fleſhy Entrals) why is it not ſo with the other parts which al men admit and conſent to be made and perfected after them? Adde heereto, that if the ſeede of the Male be both the efficient, and the matter of the Infant, there is no reaſon but the male may alone beget an infant in himſelfe: ſhall the Nature of the ſeede be idle and at reſt, which all Philoſophers with one conſent doe agree, is alwayes actiue and operatiue? Finally, is it poſsible that ſo ſmall a moment of ſeede, as ordinarily ſufficeth for the generation of Man, ſhould bee ſufficient for the delineation of ſo many hundreds, nay thouſands of Bones, Griſtles, Ligaments, Arteries, Nerues, Veynes, Membranes, &c? Wherefore, the ſeede hath not the nature of a materiall, but onely of an effi-

The fourth. *Hippocrates.*

The fiſt.

The ſixt.

efficient cauſe of mans generation.

There are alſo two places in *Galen*, which ſeeme to fauour the opinion of the *Peripatetikes*. The firſt, is in the ſecond Booke *De Naturalibus Facultatibus*, where hee ſayth, *The Seede is an Effectiue Principle of the Creature, for the materiall is the Menſtruall Blood*. The other in the third Chapter of the ſame Booke, where he ſpeaketh verie plainly. *There is great difference* (ſaith he) *betweene the workemanſhip of Phydias, and of Nature. For Phydias of waxe can neuer make Iuory and Gold, but Nature keepeth not the olde forme of any matter, generating of bloud bloudleſſe parts. As for example, Bones, Griſtles, Nerues, Veines, Arteries, all bloudleſſe, yet made of bloud.*

But the trueth is, that *Galen* was of another minde, to wit, that all the Spermaticall parts were made of ſeede, as appeareth in his Bookes *de Semine*, where hee inueyeth purpoſely againſt *Ariſtotle* concerning this matter, teaching that the ſeede is both the efficient and the materiall cauſe of their generation. The efficient, in reſpect of the Spirites; the matter in reſpect of the Craſſament of it. And indeede, that admirable and vnimitable ingenie or diſcourſe of *Hippocrates*, did firſt bring this light into the worlde, as appeareth in his Bookes *De Natura pueri de Principijs*, and the fourth *De Morbis*. And *Ariſtotle* himſelfe is conſtrained to confeſſe as much in the firſt Booke of his Phyſickes, and in his Bookes *De gener: Animalium*, where he ſayth, that ſome parts are made onely of an Alimentarie excrement, ſome of an Alimentarie and a Seminall together. Beſides, not to ſtand vpon authorities, wee haue waight of Reaſon to prooue it. The ſeede of Man, is white, froathie, and thicke, and when it is caſt into the Wombe, if Conception follow, it is retained; for out of hand the mouth of the Wombe is ſo exquiſitelie cloſed, that a needle cannot finde entrance without offence.

The contrarie opinion of the Phyſitians.
Authorities of Galen.
Ariſtotle.
Reaſons.
The firſt.

This all Women know full well; and the Muſicall Huſwife in *Hippocrates*, when ſhee knew that the ſeede ſhe had receyued came not away, on the ſeauenth day with a *Lauato* I trow, or ſome ſuch violent friske, ſhee auoyded her Conception. For, if the ſubſtance of ſeede be retained in the Wombe, it muſt of neceſsitie bee reſolued into nothing, or ſomething muſt be made of it; or elſe (as the Peripatetikes dreame) it muſt bee diſſolued into winde and vapours. The firſt, no Philoſopher will aſſent vnto; for, as nothing is made of nothing, ſo that which is ſomething, cannot vaniſh into nothing. The laſt, *Galen* diſprooueth by this argument, Becauſe when the ſeede is conceyued, the Wombe is contracted, and the ſeede narrowly embraced on euery ſide, ſo that there is no place leſte for any diſtending winde: adde heereto, that if the ſeede were diſſolued into winde, the wombe beeing diſtended, would be afflicted with exquiſite torments; for of one part of earth, are made ten of water, and of one of water, ten of aire.

Hip. Pſaltria. l.b. de nat. pueri

It remaineth therefore, that of the Craſſament of the ſeede, ſome parts muſt neceſſarily be framed, and thoſe are they which are called ſpermatical, Bones, Griſtles, Nerues, Veynes, Arteries, Membranes, &c. And this is prooued by theyr whiteneſſe, and by the thickneſſe, and the lentor or ſlimineſſe of their ſubſtance.

Moreouer, that the Spermaticall parts are made of ſeede, wee may thus demonſtrate. Bones, Cartilages or Griſtles, Membranes and Ligaments, are bloudleſſe and white, and therefore they cannot be made of blood immediately, as fleſh; but of bloud chaunged, whitened, and incraſſated, and then what differeth it from ſeede? Nature therefore ſhould bee very ydle, if ſhee ſhould enacuate and expell a matter fyt for the generation of thoſe parts, and (as if ſhee had forgot her ſelfe) ſhould endeauor to bring blood into that forme of which ſhe had at the fyrſt hand ſeed enough.

The ſecond.

To theſe demonſtrations of *Galen* (at which *Argenterius* like a Detractor ſcoffeth) we will adde other Reaſons. VVhen the ſeede is iniected into the boſome of the wombe, the wombe is inſtantly contracted, and the plaſticall or forming Facultie thereof, rayſeth vppe the ſleeping power of the ſeede; and then his ſpirites and natiue heate, commence theyr action. Now this action thus inſtantly begunne, woorketh vppon ſomewhat: not vppon bloude, becauſe yet there is no confluence of it to the part. For who will ſay, That in Coition there is a double ſecretion, one of ſeede, another of bloud at one and the ſame time? The Peripatetike himſelfe will not yeelde to ſuch a Soleciſme in nature; but we know, that that which is auoyded in the acte of generation, is ſeede, and not blood.

The third.

It is therefore the Craſſament of the ſeede vpon which the Spirits doe worke, in which they haue their aboade as in their proportionable ſubiect; this they turne and toſſe

on euery side; the dissimilar parts of it they separate, framing of the thicker bones & gristles, of the slimy Membranes and vessels; all which, being scored out as the rude and first draught of a picture, wherein are nothing but the maister lines; the seuenth day the blood floweth vnto it, to make the *Parenchymata* or flesh of the entrals, and to fill vp the vacant distances of the Fibres. If therefore in the very conception, no bloud doe flow from the Veynes of the wombe vnto the masse of seede conceiued, how can wee imagine, that the first delineation of the parts, is made of blood? Againe, the blood wherewith the infant is nourished, and of which the *Parenchymata* are made, must passe by veynes, veynes I say, not of the mother, for then it would encompasse the seede onely, not insinuate it selfe into the parts of it; but of the infant; and for this purpose is the vmbilicall veine formed, called therefore the *Nurse or Foster* veine, so that this Veine must of necessity bee made before the blood can come vnto the seede; and of blood it is not made, because there is yet no affluence of it. If you shall say, that blood is powred into the capacity of the womb by the small veines of the wombe: I aske why is the Infant not immediately nourished by the same veines? What neede was there that any vmbilicall veine should be formed? Finally, another demonstration that the parts are made of seede may be on this manner. The seede of the male and female is of one nature, colour and manner of generation, they haue both the same vessels of preparation, concoction and eiaculation, onely they are distinguished in perfection, for that the seede of the male is hotter and better laboured. Now all men do acknowledge, that the seede of the Female is the materiall principle of the parts; why then do they deny it to the crassament or substance of the seede of the male? Wee therefore conclude and determine, that both seedes are not onely efficient but materiall Principles of the spermaticall parts.

The fourth.

The fist.

The determination.

But that we may leaue no enemies at our backes to interrupt our victory as wee gaine the field before vs, let vs make answere to such arguments as are brought against the truth of this assertion. And first for *Galen*: where hee writeth, that the spermaticall partes are made of blood, he doth not vnderstand an immediate generation, that is, that the Bones are made immediately of red blood, as is the flesh; but of blood passed through diuers alterations and mutations of dealbation and incrassation. And what I pray you is this, but to say they are made of seede?

Answere to the aduerse arguments.

Galen expounded.

To the first argument I answere thus. There are two things to be considered in the seed, the Spirit and the Body. In respect of the Spirit, *Aristotle* in his first Booke *de partibus Animalium* saith, the seede is the nature, the principle, and the efficient of the thing begotten; and *Galen* in his second Book *de Semine*, calleth it *Formator fœtus*, the former of the Infant. In respect of the Crassament or body, it is called a material & passiue principle, so that the same part of the seed shal not be the Actiue & Passiue principle, the act and the power, the moouer and the mooued, the matter and the forme as the Peripatetiks would perswade vs it must be, if that opinion were true. And *Auerrhoes* giueth an instance how these respects may be separated, so that the same thing may become the moouer and the mooued in diuers considerations. For example: In a stone, the grauity or weight mooueth downward, and the stone is mooued; so in the seede, the spirit is the moouer, and that which is moued is the Crassament or substance.

Answere to the first Argument.

Auerrhoes.

In those things that are done by Art, wee confesse the Artizane is no part of his owne workemanship; but in naturall things there is not the like reason. And this *Aristotle* teacheth in the 5. Chapter of his Booke *de Spiratione*. There is a difference (saith hee) betwixt Art and Nature, for Art vseth heate onely as an Instrument; but Nature vseth it both as an Instrument, and as a matter. For the fire which is vsed by the Artist to his worke, is not a part of the worke it selfe; but the heate, which is in nature, is diffused thorough the substance of that she intendeth to accomplish. Some Learned men make a two-fold kinde of Instrument, *Wherewith* and *Wherein*. The Instrument *Wherewith*, remaineth not in the part that is formed: but that *wherein* remaineth, as being the subiect of the forming faculty, otherwise there should be a formall transition, or transition of the forme, out of one subiect into another. For the forming faculty should leaue his proper subiect, that is, the seede, & transport it selfe into the blood.

Answere to the second. *Aristotle.*

To the third; we do not deny that Bones and Spermatical parts are norished by blood, but that blood hath gotten and acquired vnto it selfe the nature of seede, in thickenesse, slimenesse, and whitenesse. Or say thus. The blood is the remote aliment of the spermaticall parts, and the seede or something like seede the immediate. To the fourth, the *Parenchy-*

Answer to the third.

Answer to the fourth.

mata

mata or flesh of the principall parts, are indeede generated of bloode; but their first foundations had their originall from seede. The Warpe is seede, the Woofe is blood. To the fist. The Male alone cannot generate in himself, although he haue both Principles in him, Efficient and Materiall, becaufe he hath no fit place for conception, norifhment, and preseruation of the Infant, yet therefore his seede cannot well be faide to be idle; for that is idle, which when it may or can, yet doth not work; but in the male it neither may nor can, becaufe he hath not a field to fow his seed in; & the seed that lyeth in the garner, cannot be faide to be doted, becaufe it groweth not; but if it bee put into the ground, then we know it is doted if it do not fprout.

To the fist.

The laft reafon *Argenterius* makes great account of, for he taketh it to bee beyond credance, that all the fpermaticall parts fhould bee made of fo fmall a quantity of feede; and therefore that he might be abfurd alone, againft all confent of antiquity he fayth, that no parts are made of feede. But truth is, that in this there is nothing admirable, but as all the workes of God are iuftly to be admired. Shall we fee a Spider weaue out of her womb a web a hundred times as long as her felfe, her felfe not at all leffened, and fhall we thinke that Nature cannot draw as fine a thred, and after by addition of competent matter, enlarge the dimenfions thereof? But let vs returne to *Argenterius*, and fee how Clark-like he difputeth againft *Galen* in this point. It is not poffible (faith hee) that fo many Bones, Griftles, Membranes, Veffels, &c. fhould be all formed of fo little feede, and therefore none of them are made of feed. A light and vaine argument, drawne from the weakneffe of his owne vnderftanding. Doth he imagine thinke we, that the geniture conceyued & delineated the feuenth day, is by that time grown into farther dimenfions then the feed which iffued from both the Parents was of? Out of doubt he was not diligent in viewing abortments. For we dare confidently and religiouffy auouch, that the firft moneth the *Embryo* although articulated, is no bigger then halfe the thumbe, yea we haue feene it at xi. weeks not aboue an inch and a halfe long, and of the thickeneffe of a good quill, though all the parts (euen of generation) were manifeftly to be feene and diftinguifhed. If any man fhal call the credit of our affeueration into queftion, let him heare *Ariftotle Probl. 36. fect. 1. & 7. de Hiftoria Animalium*, where he auoucheth, *If a Male Infant of forty dayes growth, be put into any other thing, it will fall afunder: but if it be caft into cold water, it gathereth together, and abideth compaffed as it were with a Membrane, which being broken, the Infant appeareth in the magnitude of a great Ant or Pifmire, and the Members of his Body may be diferned.* What will *Argenterius* fay to this? Is not the feede of greater quantity then a great Pifmire? Let him remember *Ariftotles* Philofophy, That in principles there is great perfection, litle quantity but abundant vertue. A fmall Acorne into how vaft an Oake will it grow? The nourifhment onely is from the earth: the extent of the parts from the vertue of the feede. But if hee will not beleeue *Ariftotle*; as fcarfely authenticall in Anatomy, wee will cite him before the Tribunall of truth it felfe, that is, of *Hippocrates*, who in his Booke *de Principijs* affirmeth the very fame. *The Geniture in feauen dayes hath whatfoeuer it ought to haue. For common and proftituted Strumpets, when they finde they haue conceiued, they vndo it within their owne bodyes by wicked meanes, and fo there falleth from them as it were a flefh. Which flefh if it be caft into cold water, and diligently obferued, you fhal in it perceyue all the members, the place of the eyes, eares, hands, fingers, thighes, feete, toes, and the fecret parts.* If therefore in the firft feuen daies the infant be fo fmall, why feemeth this vnreafonable, that of the feede at once caft into the wombe, the firft threds and foundations of the fpermatical parts fhould be formed, which afterward by the continuall appofition and aflimulation of Aliment, receiue their increment and perfection?

To the laft. *Argenterius.*

An example of the Spider

Argenterius confuted.

The fmall quantitie of the Infant after it is formed.

Ariftotle.

Axiome.

Example.

We conclude therefore, that all the fpermaticall partes are generated of the Craffament or body of the feede, as of a materiall Principle. And this Craffament, although it feeme at the firft view homogeniall, that is, hauing al parts of it alike, yet notwithftanding containeth in it parts of vnlike natures; thinner, thicker, fatter, flimier, fome fyt for concretion or gathering together; others for tenfion and diffufion, all which are feparated by the fpirits and heate of the fame feede, ftirred vp by the Plafticall or formatiue power of the wombe: and fo much concerning the fyrft queftion.

The concluſion of the queſtion.

Whether the Spermaticall parts can reioyne againe after they be violated and ſeuered. QVEST. VIII.

Proofes that the ſpermaticall parts may reunite.

The firſt argument.

CONcerning the coalition or reioyning of Spermaticall partes there is great contention; I know that many, as well of the ancient as later writers haue, and do maintain; that they may all reioyn κατὰ πρῶτον σκοπὸν; that is, *according to the firſt intention*, as Chirurgians vſe to ſpeake, and this they eſtabliſh by theſe arguments. Where the Efficient, Materiall, and Finall cauſes of coalition are, there is nothing to hinder a reiunction; but in young, growne and aged men, this threefold cauſe is preſent, therefore in all ſuch there may be coalition: the Maior propoſition of it ſelfe is cleere enough; the Minor is thus confirmed. The Efficient cauſe of coalition is the forming faculty, which vſeth heate as her inſtrument; this faculty is ſeated naturally in euery part, but more manifeſtly in the ſolid parts then in the fleſhy. The Matter of the ſpermaticall parts is ſeede, of which there is ſufficient plenty, as for nutrition and accretion or growth, ſo alſo for a newe generation. *Hippocrates* alſo, *Galen* and *Ariſtotle*, doe agree, that the ſeede is an excrement, or rather ſurpluſage of the laſt concoction; now the laſt and moſt abſolute aliment is plentifull enough, neuer fayling vnleſſe it be in the vtmoſt limit of decrepit age, and therefore the excrement or ſurpluſage of it is not wanting. Moreouer according to *Hippocrates*, veines, arteries, nerues, and all ſpermaticall parts haue the power of procreating ſeed. Neither is the Finall cauſe wanting, for a broken bone and a diuided veine, doe after a ſort deſire and ſtriue to be reunited; becauſe the ſolace and comfort of Nature conſiſteth in vnion, as her ſorrow and deſolation in ſolution. They haue alſo another argument not inelegant; Hollow vlcers are filled vp with new fleſh, intertexed and wouen with ſmall and capillarie veines, arteries and ſinewes; for that fleſh is ſenſible, it liueth and is nouriſhed, therefore of neceſsity by veines, arteries and ſinewes.

Hippocrates. *Galen*. *Ariſtotle*.

The ſecond argument.

Who is ſo mad that he dare exclude the teeth out of the number of ſpermaticall parts? but they grow againe after they be extracted. *Hippocrates* in his book *de Carnibus*, maketh a threefould generation of the teeth. The firſt from the ſeede in the wombe; the ſecond from milke; the third from more ſolid aliments. Now if by the tranſmutation of the aliment the ſpermaticall parts doe encreaſe, why ſhall they not be reunited, ſeeing that *accretion* is one of the kinds of *generation*? *Galen* in the ſeauenth chapter of the fift booke of his Method, and in the fourteenth of his Method writeth, *That he hath ſeene many ſouldered & reunited arteries*. He telleth a ſtory of a young man who had an artery diuided in his arme, which afterward did perfectly reunite againe. Alſo in his 91. chapter of his booke *de arte parua*, and in the fift chapter of the ſixt booke of his Method, hee affirmeth that *the bones of Children may reunite*. Theſe are the reaſons which they vrge, and wherewith they goade vs to ſubſcribe, that ſpermaticall partes euen according to the *firſt intention*, may reunite themſelues.

The third argument. *Hippocrates*.

The fourth. The fifth. *Galen*.

Thoſe which haue giuen vp their names againſt this opinion, doe labour to prooue the contrary by authorities and by reaſons. And firſt they oppoſe the ſixtieth *Aphoriſme* of the ſixt ſection; *If a bone, a griſtle, a nerue, or the fore-skin bee cut, they neuer reunite againe*. *Galen* in the 8. and 10. chapters of his firſt booke *de ſemine*, as alſo in the 87. chapter *de arte parua*, writeth that *the fleſhy parts doe eaſily conglutinate, ſpermatical neuer*. And in the 91. chapter *Artis parua*, he eſteemeth *a fracture in a bone to bee incurable, becauſe bones doe not reunite according to the firſt intention*. Theſe authorities are ſeconded by Reaſon; firſt, both the Efficient and Material cauſes of reunition are wanting. The Efficient is the formatiue facultie, which is onely in the ſeede, whoſe drowſie & lusking faculty is onely brought into act by the heate of the wombe. True it is, that there remaineth in the ſolid parts, a faculty conſerning the figure of the part; but to make any thing anew is proper onely to the ſeede, the Efficient therefore is wanting.

The contrary opinion Authorities for it. *Hippocrates*.

Reaſons.

What is to be thought.

Neither is there any Matter at hand, as the ſeede; which being generated onely in the teſticles, how can it be transferred to the head, the arme or any other part?

Three concluſions, and 3. foundatiõs. The firſt foundation. A double reunition.

Out of theſe waues and ſtormes of opinions, that wee may redeeme and eſtabliſh their minds that are yet incertainely toſſed to and fro, and ſet them ſafe aland in a quiet harbor, wee will determine the whole queſtion by three concluſions, and theſe concluſions ſhall haue three foundations. The firſt is taken out of the determinations of *Galen*, in the 90. and 91. chapters *de arte parua*, and is on this manner. There is a double reunition of diſſol-

ued

ued parts; *One after the first scope, another after the second scope or intention.* The first intention is ἐν τῇ κολλήσει; that is, in *Agglutination* which we call σύμφυσις. The second ἐν τῇ ἕνωσει; that is, in *Colligation* which wee cal πώρωσις. The first is sometimes accomplished without any *medium*, that is, ought comming betweene; as in flesh which being cut or diuided, is presently glued together; sometime with a *medium* of the same kinde, which we call *medium homogeneum.* The second intention is accomplished with a *medium* of another kind, which wee call *medium heterogeneum*, as with a *Callus*, Cicatrice or scarre, and such like which are not of the same kinde with the part dissected or separated. Now that parts may reioyne according to the *first intention* and by a *homogeny medium* or meane, many things are required. First, the strength of the Efficient, to wit, of the formatiue faculty and of the natiue heate. Againe, a due disposition of the Matter, which must be plentiful, that it may suffice nutrition, accretion, and a new generation. Moreouer it must bee ministred not by little and little, but togetherward, that is, it must bee sodainely and at once altered, that nothing of a diuers kinde may interpose it selfe betweene the disioyned parts in the time of that alteration.

What are the first and second Intentions in Coalition.

What things are required to the first intention.

Another foundation is this; Of spermaticall parts some are soft, as veines; some harder, as arteries and nerues; some hardest of all, as bones. The third foundation, That in Infancy and Child-hood all the spermatical parts are exceeding soft, and the bones like curdled or gathered butter, and coagulated or sammed cheese; but in those that are growne to further yeares, they become dryer, and in old men very dry, because our life is nothing else but a drying of the spermaticall parts.

The second foundation.

The third.

These foundations being thus layd, we conclude thus triplewise. First, that fleshy parts are easily regenerated, and doe reunite according to the *first intention*; but spermaticall parts very hardly. Secondly, in Children and moyst natures, all the spermaticall parts, euen the bones may reunite by a homogenie meane; in those that are growne some parts may, but not all; veines often, arteries more rarely; bones neuer. In old men there is no hope of coalition in a nerue, membrane, arterie, veine or skinne, which is called νεύρωσις; none in a gristle broken, eaten a sunder, torne or dissected, which is called χόνδρωσις; none in a bone broken which is called ὀστέωσις. Thirdly, in all ages and sexes euen to the vtmost extent of old age, all the spermaticall parts will reunite according to the *second intention*, that is, by a *medium* or meane heterogenie, or of a diuers kinde, which in a bone is called *Callus*, in the rest a Cicatrice, or a scarre.

The triple conclusion.

First.

Second.

Third.

The truth of the first conclusion is thus confirmed; the mutation or change of bloud into flesh, is easie and expedite, because it is accomplished by a light and almost single and simple alteration. For bloud is red, hot and moyst; so also is flesh, redde, hot and moyst; one thing only is required; that the bloud be incrassated; there is therfore a fit & apt disposition of the matter. The Efficient is likewise very strong, because fleshy parts are hotter then spermaticall: whereupon it commeth to passe that they sodainly reunite, sometimes without any meane at all; sometimes with a Meane, but alwayes of the same kind and homogenie; yea oftentimes the flesh groweth so importunately in woundes (which wee call *hyposarchosis*) that we are constrayned to inhibite and restrayne the increase with *corrasiue* Liniments and poulders. But on the other side, the spermaticall parts doe very hardly reunite according to the *first intention*, because of the *weaknes of the Efficient*, the *ineptitude or vnfitnesse of the Matter*, and *the siccitie or dryneffe of the parts.* The Efficient is heate, which being weake, hath enough to doe to intend conseruation and nutrition, and therefore cannot perfectly restore the decayed and vanished substance of the solid parts. *It is enough* (sayth *Galen* in the 59. chapter *Artis parua*) *if it hinder them from being exiccated or dryed vp.* How shall it then laudably indeuour a new generation, when it cannot preserue them in that state in which Nature produced or brought them foorth? Haply there will be a sufficiency of Matter; but it cannot flow together ward and at once, because the mutation or change of bloud into a bone, cannot be accomplished but by long interpolation and many meane alterations: first into marrow, then into glew, and so into seede; of red it must become white, of moyste it must become drie, of liquid it must bee incrassated or thickned; in a worde, it must alter the temper and all the qualities. Wherefore, because the aliment doth not flow but by little and little to the nourishment of the bones and the spermaticall parts; it commeth to passe, that the excrement which resulteth or ariseth out of the nourishment, doth interpose it selfe betweene the disioyned parts before the bloud can passe thorough those diuers alterations, and so breedeth a *Callus*. There is also another impe-

The confirmation of the first conclusion.

A threefold cause why spermatical parts do not reunite.

1 The weaknes of the Efficient.

2 The indisposition of the Matter.

impediment from the neighbouring parts; as if they bee fleſhy they preuent the coalition by filling vp the vacuitie or empty ſpace.

3 The hardnes and ſiccity of the parts.

The laſt cauſe of the difficulty of coalition, is the ſiccity and hardneſſe of the ſpermaticall parts. For thoſe things that are dry are very hardly vnited; and the Philoſopher in all mixtions requireth ſome watery moyſture, that by it as by a glew, all the reſt may bee vnited.

The confirmation of the 2. concluſion.

The ſecond concluſion is thus ſtrengthned: Children becauſe they are not far off from the principles of generation, haue the Efficient cauſe very ſtrong and forcible: they haue aboundance of naturall heate, plenty of ſpermaticall Matter and that very apt, which is ſodainly and eaſily changed, becauſe of the ſoftnes and ſuppleneſſe of the ſpermaticall parts. In growne men the veines becauſe they are ſoft and beſide at reſt from growing and extenſion, are eaſily glued together; but the arteries very hardly, as well by reaſon of their continuall motion which hindereth reunition, as alſo becauſe of the hardneſſe of their coates, for they are (as ſayth *Herophilus*) fiue-fould thicker then the veines. Some haue obſerued that many parts, albeit they be ſoft doe neuertheleſſe not reunite, becauſe of the excellency and neceſsity of their action; for that the creature dyeth before they can be reunited; ſo the fleſh of the heart being diſſeuered is neuer reunited, becauſe the man dieth inſtantly, by reaſon of the interception of a duty or function of abſolute neceſsity for the preſeruation of life.

Herophilus.

The confirmation of the 3. concluſion.

The third concluſion is ſo euident of it ſelfe, that it needeth no probation at all; for at all times ſpermaticall parts doe reunite by a heterogenie meane. If the skin bee wounded there euermore groweth a cicatrice or ſcarre vppon the ſeparation. A broken bone is alwayes and at all times ſouldered with a knotty *Callus*; notwithſtanding for further illuſtration two problemes or difficulties are to be cleered.

The firſt probleme.

The firſt, why if a bone be caued or hollowed by an vlcer ſo as there is any loſſe of the bone, the fleſh can neuer be generated ouer it? For *Hippocrates* in the 45. Aphoriſme of the ſixt ſection ſayeth, *All vlcers that are Annual muſt of neceſsity looſe ſome part of the bone vnder them, and the ſcarres or Cicatrices become hollow.* Why doth not the fleſh inſinuate it ſelfe into the hollow place of the periſhed bone? Or if there be a *Callus* generated, why is there not alſo fleſh generated about it?

The anſwere to it.

I anſwere, that fleſh cannot bee generated in the cauitie of the bone, becauſe fleſh is not made but of fleſh, a nerue but of a nerue; now the lippes or extreame verges of the cauitie are bony: what therefore ſhall they endeuour to generate? Surely either nothing at all, or elſe a bone or a *Callus*. If in the place of that which is loſt there be no body ſubſtituted, then is there no foundation layde whereuppon fleſh may ariſe. The bone it ſelfe in dry and hard bodies cannot be regenerated; therfore Nature not being able to doe that ſhe would, doth that ſhee can, ſo ſhee maketh a *Callus*.

Obiection. Solution.

But what is the reaſon why no fleſh can grow vpon this *Callus*? Becauſe fleſh is a liuing and animated thing, and a *Callus* without life altogether: now that which is animated, and that which is inanimated, that which liueth and that which is dead, do differ in the greateſt difference, that is in the kinde and very forme; wherefore the *Callus* which is without life, cannot be a foundation to build fleſh vppon which hath life. That a *Callus* is without life, may be demonſtrated, becauſe it is produced of the excrement of the bone and the neighbour parts.

Obiection. Solution.

If it be obiected, that if it bee without life and not nouriſhed, it could not endure and grow all the time of a mans life, which that it doeth is more then manifeſt: the anſwere is at hand; It encreaſeth not by nutrition, but by appoſition of the matter, as the haires, and the nailes; againe, it endureth as long as the bones receiue any nouriſhment, from which there alwayes redoundeth an excrement, whereby it is preſerued.

The 2. probleme. Solution.

The ſecond Probleme is; why if the *Callus* come from the excrement of the bone, is it not generated in a ſound bone which alſo yeildeth an excrement? Becauſe, when the bone is weakned by a wound, the excrements are more plentifully driuen vnto it from the neighbour parts; euen as all the parts that border vpon a wounded part, doe thruſt downe their ſuperfluities vnto it. And thus I thinke I haue touched, I hope cleered, all difficulties which concerne the coalition of the ſpermaticall partes; it is therefore nowe high time to turne our diſcourſe ſome other way.

Anſwere to the former obiections. To the firſt.

But before we leaue the field, it ſhall not be amiſſe to diſparkle all the forces of our aduerſaries, that we may be ſayd to haue gayned an intire and accompliſhed victory. The firſt argument of the firſt opinion is true onely in Children; for in old men euery man will confeſſe there is both a weakeneſſe of the Efficient, and a want of the Matter. The ſe-

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cond is a captious Sophiſme, made to intrap the ignorãt. For it is not neceſſary that wher-ſoeuer there is ſence, there alſo ſhould be a nerue, for then the whole body ſhould bee a nerue; it is ſufficient, if a nerue be deriued vnto the part, by whoſe illuſtration and irradiation, all the particles of that part haue ſence; the ſame we may ſay of Veines and arteries. For Mathematicall or locall contaction is not required to euery action, but onely phyſicall and naturall. To the ſecõd.

For their third argument, I anſwere, that there is not the like reaſon of the teeth, and of other bones; for the teeth after they be drawne doe growe againe, by reaſon of theyr End, and by reaſon of their Matter. By reaſon of their End, becauſe they are ordained to chew, mittigate, and prepare the meate for the ſtomacke: and therefore as they encreaſe euen till the end of our age for our neceſsity, becauſe they are continually waſted by attrition or rubbing one againſt another; ſo for the ſame neceſsity they are regenerated when they faile. Beſide, if you regard the matter of their generation, there is aboundance of it contained in the cauities of both the iawes; add heereto, that the teeth are not incompaſſed with any other part which ſhould hinder their generation. To the third.

Fourthly, they vrge, that Accretion and Nutrition are kinds of generation; but bones do grow and are nouriſhed, why therefore may they not be reunited? Wee anſwere, that this is the order and diſpenſation of Nature; that firſt the part be nouriſhed; then, if there be any ouerplus, that the part encreaſe into all dimenſions; and after this expence, if there yet remaine any ſurpluſage of aliment, that then it may go to the reſtoring of the want or defect in the part; but ſeede is neuer generated in that quantity; that it ſhould be ſufficient for nouriſhment, accretion, and beſide for a new generation. Tothe fourth

In the wombe indeede the Spermaticall parts are eaſily generated, becauſe both the matter is copious, and there is moreouer ὁ δημιουργὸς σπλὴν, a double Workeman, one in the ſeede, another in the veſſels, or as ſome thinke, in the ſubſtance of the wombe; but after wee are borne, they are hardly generated, becauſe one of the workemen is abſent, which formerly was in the ſeede, or aſsiſtant vnto it. As for the authorities of *Galen*, they do not conclude either that all ſpermatical parts do admit coalition, or ſom alwayes; and therefore we willingly ſubſcribe vnto them, without any præiudice vnto our cauſe. Anſwer tothe authorities of *Galen*.

The argument of the other Opinion, which denieth the formatiue faculty to the ſpermaticall parts, yeelding it onely to the ſeede, is eaſily ouerthrowne; becauſe the ſeede (according to *Hippocrates*, *Ariſtotle*, *Galen*, and all Phyſitians) containeth in it the Idea or formes of all the parts, which it receiueth from the ſolid or ſpermaticall parts. True it is, that in the Bones there is, that I may ſo ſay, a power to bonify or make bones, in the veins to veinefy, ſo there be an apt diſpoſition of the matter. But when wee ſay that Bones are nouriſhed, encreaſed, and do reunite by ſeede, we do not vnderſtand prolificall ſeede ſuch as is apt for generation; that is onely in and about the Teſticles, where it attaineth his forme and perfection, but we vnderſtand ſomething like vnto ſeede. Finally, the authorities of *Hippocrates* and *Galen*, doe conclude onely, that the hinder parts cannot reunite, which thing we haue already demonſtrated in the ſecond Concluſion. And thus much of the ſecond queſtion. Anſwere to the argumẽts of the ſecond opinion. To the authorities of *Hippocrates* & *Galen*.

QVEST. IX. *Whether the Spermaticall parts be hotter then the Fleſhie.*

IT were either ſuperſtition or oſtentation to quote all the places of *Hippocrates*, *Ariſtotle*, and *Galen*, wherein they auouch, that vnbloudy parts are colder then bloudy; but no man that euer I read of, did euer deny that fleſhy parts are bloudy, and ſpermaticall either without bloud, or at leaſt but lightly moiſtned therewith. Vpon theſe premiſes any man may gather the concluſion; or if they will not inferre it, it will ariſe of it ſelfe. Yet there are ſome among the late writers, who would faine perſwade themſelues, that the Spermaticall parts are hotter then the ſanguine or bloudy. *Iobertus* ſometimes the learned Chancellor of the Vniuerſity of *Mompelier* in *France*, ſet forth a Paradoxe concerning this matter, wherein he diſputeth many things with great wit and ſubtility; ſome probabilitie, but leſſe ſubſtance of truth, concerning the in-bred heate of the ſpermaticall partes. I haue alwayes much eſteemed the learning and edge of the mans wit, yet becauſe he is the Chiefetaine of them who hath impeached the authority of the receiued opinion concerning this matter; I am conſtrayned to diſſent from him, and will not thinke it preſumption to examine his arguments one by one, that the truth may more euidently appeare. *Iobertꝰ* opinion of the heat of ſpermaticall partes.

Thoſe

His first argument.

Those things (sayth he) that arise of others do sauor of the principles from whence they arise; but the seede from which the spermatical parts do proceed, is hotter then bloud; and therfore the spermatical parts are hotter then the sanguine or bloudy. Now that the seed is hotter then the bloud, may thus bee demonstrated. *Hippocrates* calleth seede fiery & ayrie; bloud cold and wateriſh. Beside, bloud is contayned in a trough or channell, but the seed passeth through vessels which haue no sensible cauities, which are certaine signes of the tenuity and heat thereof. But this reason seemeth to be more washy and loose, then may answere the strength and vigor of so great a Clarks wit. For there are two things to be considered in seed (as sayth *Galen* in many places) the crassament, corpulencie as I may say, or body of it, and the spirites wherewith it is aboundantly stored: in reference to the former the seed is sayd to be watery and earthy; in reference to the spirits, fierie. The spirits are the instruments of the soule, by which that noble architect formeth her mansion or habitation out of the seede, working and forming it into parts conuenient. These are called forming spirits, and in respect of these, the seed is sayd to be *artifex*, a workman, and carrieth the nature of an Efficient cause. The watriſh and cold body of the seede, is the matter of the spermaticall parts. I conclude therefore that the whole seede considered with all his parts is hotter then the bloud, becaus it is fuller of spirits; but if the seede be robbed of his spirits, then is it colder then the bloud; and therefore being auoyded, the heate of it presently vaniſheth, and by the coldneſſe of the ayre it becommeth libuid and black: and such did *Galen* acknowledge the matter of the spermaticall parts to be.

The answere to the former argument.

Two things to be considered in seede, the body and the spirits.

Iobertus his 2. argument.

This first argument *Iobertus* strengthneth with another, thus. The conformation or structure, and scite or position of the spermaticall parts doe manifestly proue their heate: for the bones occupy the in-most place, and are couered on euery side with flesh, as are also the nerues, least their ingenit or in-bredde heate should vaniſh or bee offended by the coldnes of the ambient ayre; but the flesh is placed about the vtmost parts. By which argument I cannot see what he wold conclude, for all these things do rather argue the coldneſſe, then the heat of the spermaticall parts; for because cold was their greatest enemy, that their weake and languiſhing heate might not bee extinguiſhed, Nature did on euery side cheriſh them with flesh, and inuest them with membranes for their defence. Moreouer, the bones are not seated so farre within for the preseruation of their heat, but because they should serue as a stay and prop to vphold all the rest of the frame. But if he will conclude that the externall parts are colder then the internal, it will follow that the skin (which all men acknowledge to be temperate) is colder then either nerues or bones.

Answere.

Iobertus 3. argument.

His third argument is yet more absurd. The spermaticall parts (sayth he) are easily offended with the cold; therefore they are hot, for alteration is made by contraries, conseruation by things that are alike. But this is vtterly oppoſite to *Galens* Philoſophy, who in his booke *de arte parua*, giueth this as a generall rule, whereby we may distinguiſh the tempers of the parts: that those which are easily offended with cold, are cold, and the hot with heate. So sayth *Hippocrates*, cold is the greatest enemy to the bones, nerues, teeth & marrow of the backe, because these parts are cold. *Galen* hath these expreſſe words in the 59. chapter of his booke *de arte parua*. *In all parts this is a common marke of the temperature, if the member doe easily grow cold, it is a signe of frigidity or rarity; if hardly, of heat or of denſity; if drying things offend it, then is it dry and raſhy, if moyſt things then it is moyſt.*

Answered. *Galen.*

Hippocrates.

Iobertus 4. argument.

Finally, *Iobert* addeth this last argument. For that many actions of the spermatical parts doe testifie that there is in them a vehement and high degree of heate; so the stomacke which is membranous, attenuateth and boyleth the meat though it be very hard; yea, the Estrich softneth yron in her maw. The bladder which is likewise membranous, baketh the stone harder then the kidneyes, which are fleshy parts. These obiections may at first sight seeme of some moment to those that are not sufficiently grounded in our Art, but we will labour to shew their weakenes and insufficiency. First therefore that obiection concerning the stomacke is full of errour: for those creatures in whome the innermost coate or membrane of the stomacke is more fleshy, doe boyle their meat more strongly: and those creatures which haue no teeth, as birds, haue a solid flesh, and very full of warmth annexed to their crops; and as for men, the inward coat of their stomacks is lined ouer with a fleshy cruſt, which *Fallopius* first of all men obserued. But go too, let vs yeild this vnto him, that the membranous stomacke doth more perfectly boile, the membranous bladder bakes the stone harder, yet it will not thereupon follow that the spermaticall parts are the hotter, but that the heat when it is retained in a more solid and fast matter, burneth more powerfully.

Answered,

A good obseruation of *Fallopius*.

Who

Who will say that a glowing yron is hotter then a flame of fire? No, it burneth more fiercely, but yet the degree of his heate is more remisse. So fire in his owne spheare, and in *aquauitæ* doe not burne, because of the tenuity and thinnesse of the matter. For the stone, it is not generated so much by a sharpe and biting heate, as by long continuance in the part, & of the viscidity and slimenesse of the matter, as we see in old men. Hence therefore it appeareth that the spermaticall parts are not hotter then the fleshy. Neither must wee admit the distinction of *ingenit* and *influent* heat; because if there bee a collation or comparison made, it must be between equals; and thus much of the third question.

Comparison.

Aquauitæ.

QVEST. X. *Whether the solid parts being once dryed, can be made moyst againe.*

THere is also beside the former three, another by-question, concerning the moystning of solid parts after they bee dryed: for the opening whereof, wee must vnderstand that the name of a solid part is very ambiguous and equiuocall. The common people call that a solid part which is firme, hard, dense or thight, and well compacted or knit together. So *Galen* calleth the flesh of the heart *solid* flesh. *Hippocrates* in the 7. section of his 6. booke *Epidemion*, calleth all the contayning parts solid, and thus fleshy parts also shall be esteemed solid. Some there are who by solid, vnderstand all animated parts, which haue a proper circumscription, and are bounded within their owne limits. Philosophers call that solid which is, τὸ ὅλον, *tale*, that is, *wholly ful of it selfe*: so the fire and the ayre in their owne spheares are sayd to be solid. So *Cicero* in the first booke of his *Diuinations* sayth, that when *Alexander* determined to weare a crowne of gold, he made doubt whether it should be of *solid* gold, or only laid ouer with gold on the outside: and according to this acceptation, all the similar particles (as we haue already shewed) are called solid, because all parts of them are equall and alike. But most properly the Physitians call those solid partes which are spermaticall, as *Galen* teacheth in the first chapter of the eleuenth booke of his Method, and in the 7. chap. of his first booke *de naturalibus facultatibus*, as also in the 16. chap. of his first booke *de semine*, in all which places he calleth fleshy parts bloudy, and spermaticall parts solid. These solid parts in the 59. chap. of his booke *de arte parua*, he calleth *primas* or the *First*; either because they are the foundations of the rest, and as it were the first threds & lines which support the whole fabrique of the body; whereas the flesh doth but as rubbish fill vppe the empty spaces betweene them; or else because seede is the first principle of the body; or lastly, because the spermaticall parts are generated before the fleshy. Now the question is concerning these true and properly so called solid parts; whether if they bee resiccated and dried, they may be by Art or Nature moistned again; that is to say, whether the Aliment that is substituted be of the same kinde with that which is wasted. *Galen* was the man who gaue the occasion to this question in the 59. chap. *Artis paruæ*. *Solid parts* (sayeth hee) *of the body can by no meanes be made moyster, it is all we can do if we can keep them from drying*. And in the 1. cha. of the 11. booke of his Method. *The quantity of the solid parts remayneth alwayes the same*. And in the 11. chap. of the tenth booke of his Method. *The siccity or drynes of the solid parts can by no meanes be cured*.

Manifold acceptions of a solid part. *Galen.* *Hippocrates.*

Cicero de diuinatione.

Which are properly called solid parts *Galen.*

Why they are called first parts.

Whether the solid parts may be moystned. *Galen.*

We imagine that this doubt may easily bee assoyled, if wee remember that in the solid parts there is a double substance; one exquisitly solid & fibrous, altogither without bloud; another which filleth vp the distances of the fibres, which is called the proper and peculiar *flesh* of euery part. The first can by no possible meanes be humected or moystned, that is to say, neither *such* nor *somuch* can be restored *how much* and of *what kind* is spent or consumed. The later may easily be restored. But least you should think this distinction to bee a brat of my owne braine, you shall heare *Galen* making mention of the very same in his Medicinal Art, and in his booke of Method. In the 59. chap. *artis paruæ*. *The solid parts* (sayth he) *which are truely solid and first parts, can by no possible meanes bee moystned; it is as much as we can do if we can hinder them from being ouer soon exiccated or dried vp, but the inter-middle spaces may possibly be filled with this or that moysture*. In the 11. chap. of the 10. booke of his Method. *In the solid parts there is a fibrous substance and there is a fleshy; so a veine which hath but a thin coate, hath many fibres intertexed or wouen with it, to which the proper substance of the veine groweth. This hath yet gotten no common name; but by way of instruction I see no reason but you may call it the fleshy substance*. This distinction therefore is *Galens* owne, and therefore the fitter for vs to rest in. And so we haue gon through all the controuersies or difficulties that concerne the nature of a part, which we esteeme to be the proper subiect of Anatomy. It remaineth now that we addresse our selues to our busines.

A double substance of the solid parts out of *Galen.* *Tantum et tale.* *Quantum & quale.* *Galen.*

THE SECOND BOOKE.

Of the parts Inveſting and Containing the whole Body: And alſo the lower belly in particular.

The Præface.

BEeing now to diſſolue this goodly frame of Nature, and to take in pieces this Maiſter-piece, it ſhall not bee amiſſe to take a light ſurvey of all the parts as they lye in order, beginning with that which firſt meeteth with the ſence. This body therefore, which indeede is but the Sepulchre of that God at firſt created, although to the eye it is very ſpecious and beautifull, yet is it but infirme and weakely defended, ſo that the ſoule is truly ſaide *Inhabitare immunitam Ciuitatem*; for to death and diſeaſes we lie open on euery ſide. The world is a Sea, the accidents and diuers occurrents in it are waues, wherein this ſmall Bark is toſſed and beaten vp and downe, and there is betwixt vs and our diſſolution, not an inch boord, but a tender skinne, which the ſlendereſt violence euen the cold aire is able to ſlice through. How then, may ſome ſay, commeth it to paſſe, that ſo weake a veſſell ſhould liue in ſo tempeſtuous a Sea, ſhould ride out ſo many ſtormes and dangers? Surely, it is put together with wonderfull Art, and framed according to Geometricall proportions, which the Engliſh Poet hath obſcurely but excellently deſcribed vnder the type of the Caſtle of *Alma*, that is, of the ſoule.

The Frame thereof ſeem'd partly Circulare,
And partly Triangulare: ô worke Diuine!
Thoſe two, the firſt and laſt proportions are;
The one, imperfect, mortall, fœminine:
The other, immortall, perfect, Maſculine:
And twixt them two, a Quadrate was the baſe,
Proportioned equally by ſeauen and nine;
Nine, was the Circle ſet in Heauens place,
All which compacted, made a goodly Diapaſe.

So that truth to ſay, it is not the matter, whoſe commencements are duſt, and conſummation clay, but the excellent proportion and ſtructure that maketh this Paper-ſconce high perill-proofe.

VVe liſt not againe to retriue the wonders we haue already ſprung, leaſt we ſhould ſeem to mingle Yarne to lengthen out our web: our paine is as great in choiſe, as others is in want. For he that would ſum vp all the rarities of Nature, which ſhee hath packed together in that goodly cabinet, had neede of the Sea for his Inke, and the ſand for his Counters.

ters. It ſhall be ſufficient in this place, to draw the Curtaine and to ſhew you the caſe, rather the Coffin or winding ſheete wherein nature hath wrapped this liuing body of death. Thoſe are foure beſides the haires, wherewith as with Flowers the coffin is garniſhed, that is, the Cuticle or Scarfe-skin, the skin it ſelfe, the fat and the fleſhy Membrane.

The Haires are a velature or couering for the more vncomely parts, a defence for the head, which we may encreaſe or diminiſh, keepe on or leaue off at our pleaſure and for our neceſsity, an ornament for the face, and finally a conuenient outlet and way of expence for the thicke and ſmoaky vapors, which otherwiſe would ſmother and choake the Braine.

The Scarfe-skin or Cuticle being voide of ſenſe in ſelfe, is ordained as a muniment to defend the skinne from the violence of outward iniuries, to attemper his exquiſite ſenſe, and ſo become the *medium* or meane of ſenſation, to couer the Orifices or mouths of the Capillarie and hairy or ſmall veſſels, which determine in the skin that the blood iſſue not from them, to ſucke vp the vaporous moyſture which otherwiſe would indecently well out of the pores of the skin, and inſenſibly to euaporate the ſame, which we call tranſpiration; and finally, to turne the roughneſſe and inequality of the skinne into a ſoft and ſlicke ſmoothneſſe, and ſo becommeth one of the principall beauties of the body.

The skin it ſelfe is the wall of the Caſtle, ſo quaintly framed, that the more fiercelie it is beſieged by the cold, the more ſafely it doth defend, and the more ſtrength it doth giue to the inward parts: and therefore *Hippocrates* ſaith, *In Winter the belly*, that is, *the inward parts of the body are hotter*; the reaſon is, becauſe all the ſpirits are immured, and the Naturall heate reſtrained from vaporing forth. But when the outward enemies are departed, then it openeth it ſelfe on euery ſide, ſo cleanſing the body of ſuch ſuperfluities, as in the time of conſtraint were contracted.

Next vnder the skin lyeth the fat, a pillow to the veſſels which run vnder it, a complement to fill vp the vacant diſtances of the Muſcles, thereby making the body plumpe, ſoft, and better proportioned; a light and ſoft veſture to keepe the ſubiected parts warm in winter, and in ſummer to defend them from heate. Finally, a Stowage or Magazine of nouriſhment againſt a time of dearth: for being diſſolued by the naturall heate, it melteth into a blood-like vapour, and returneth againe into the veſſels, and ſo becommeth a ſubſidiary Aliment in times of Neceſsity, Nature being at her own finding, and teaching vs with how little ſhe can content her ſelfe.

Finally, the fleſhy Membrane as an avant Mure or inward counter-ſcarfe, is ordained as a ſecret defence to hold out a ſecond aſſault, if the outward ſhould bee won by the enemy. It preſerueth alſo the fat, that it is not molten with the perpetuall motion of the Muſcles. It ſupporteth and ſuſtaineth the paſſages of the veſſels which run from within forth to the ſurface of the body. And to conclude, as a mound of earth within a Citie, ſerues to make vp the breaches of the wall, ſo doth this Membrane being fleſhy, helpe to conſolidate the skin being wounded, or otherwiſe violated, which without fleſh was impoſsible to be accompliſhed. And theſe are the outward defences which are generall to the whole bodye. There are ſome alſo more particular to the lower belly, with which in our Anatomical adminiſtration, we muſt begin according to the order of Diſſection: but firſt we wil giue you a generall view of all the regions & outward parts of the body, calling euery one by theyr names, and diſciphering them in two Tables, to which wee haue added alſo their expoſition, that the young Anatomiſt being in the beginning acbuainted with the appellations of the outward parts, may not be puzled in the future Diſcourſe.

CHAP. I. *A Diuiſion of the body of Man.*

Diuers diuiſions of the body.

Our diuiſion.

The vpper region which is the head.

Iocles Cariſtius in an Epiſtle to King *Antigonus*, diuides the body of Man into the head, the cheſt, the belly, and the bladder. The Egyptians into the head, the necke, the cheſt, the handes, and the legges; we will part it into three regions, and the ioynts. The three regions are, the vpper which is the head, the middle which is the cheſt, and the lower which is the belly. The vpper region or the head, is circumſcribed or limited by the crowne, and the firſt racke bone of the necke. The ſecond Region the later writers do call *venter medius*, or the middle belly and the cheſt. *Hippocrates* in his Aphoriſmes calleth it the vpper belly, but in reference to the lower: and the cheſt in his Booke *De Arte*, is taken for the whole trunke of the body, for he writeth, that *the Liuer is ſcituated in the Cheſt*. This ſecond or middle Region is likewiſe limited by his bounds, the vpper part with the *Clauicles*, ſo called, becauſe they do *claudere*, that is, ſhut vp the Cheſt: we call them patelbones: below, with the breſt blade and midriffe, which like a partition wall diſtinguiſheth this middle from the lower region. On both ſides it is encloſed with twelue Ribs, before with the breſt

The middle region which is the Cheſt.

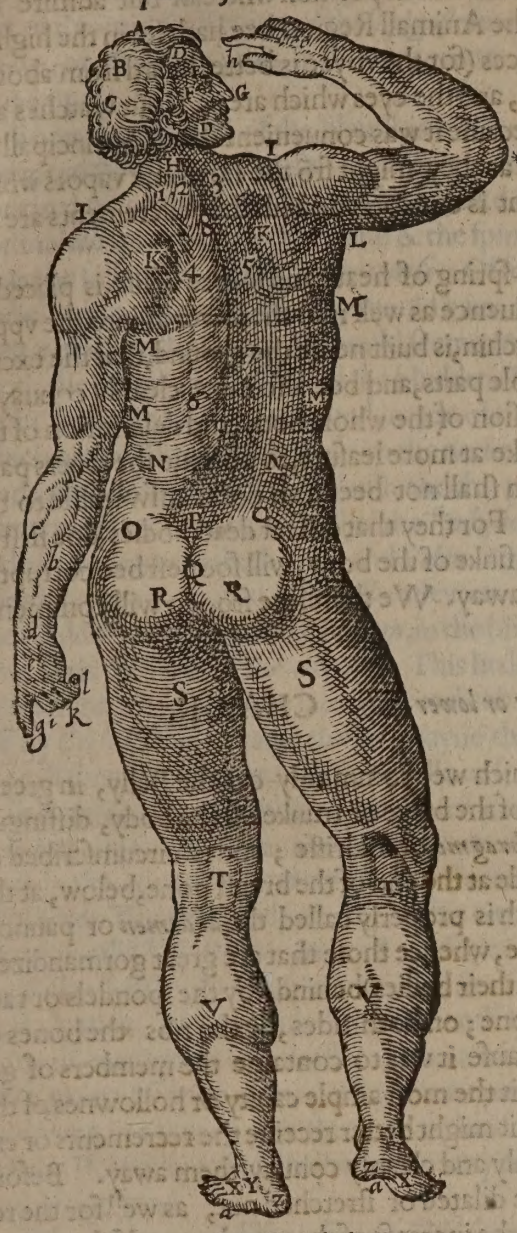
TABVLA I. *The firſt Table, ſhewing the outward and fore-parts of the body.*

A The hairy Scalp, cald τριχωτός.
b The forhead cald *Frons*, μέτωπον
c The temples cald τέρατα, κρόταφοι
From *b*. to *d*. The compaſſe of the face.
e The greater or inward corner of the eie, cald *Canthus internus*.
f The leſſer or externall angle of the eye, cald *Canthus externus*.
* The lower eyebrow which is immooueable, *Palpebra*.
g The cheek-bal cald *mala*, μῆλα.
h the cheek-puf cald *bucca*, γνάθος
i The ridge of the noſe cald *Naſus externus*, ῥὶν.
K The noſthrils cald *nares*, μυκτῆρες
L The outward eare, *auris externa*
m The mouth made of the two lips, cald *Os*.
n The chin called *mentũ*, γένειον.
o The neck, *collũ* αὐχὴν & τράχηλος.
Frõ *o*. to *e*. the piller of the neck, *truncus*, & ὄλμος.
pp. The hollow of the neck, called *iuguli*, σφαγαὶ.
qq. The patel bones, *claues* κλεῖδες
r. The cheſt *pectus*, στέρνον.
ſ. The right breaſt.
ſſ. The left breſt: to this Region we apply cordiall *Epithemations* moiſt and dry.
tt. The nipples of the breſts, *Papillæ* θηλαὶ.
u. The trench of the heart which the Ancients called καρδία. The Latines *ſcrobiculus Cordis*. This part is anointed for the mouth of the ſtomacke.
Frõ *u* to E. the lower belly, γαστὴρ
x. The *Epigaſtrium* or vpper part of the lower belly.
yy. The *Hypochondria* or *Præcordia*
* The outwarde Liuer-remedies are applyed to this place.
z. The region of the nauill, called *vmbilicalis*, or the middle part of the lower belly.
A. The nauil *vmbilicus*. The root of the belly, ὀμφαλὸς.
BB. the ſides, *Latera*, πλευραὶ.
C. *Hypogaſtrium*. the watercourſe *Aqualiculus*, the lower part of the lower belly, ὑπογάστριον.
DD. The flankes called *Ilia* and λαπαρῶνες.
E. The Groine called *pubes* or *pecten*, κλεὶς ἢ ἧβη.
FF. The Leske cald *inguen*, wher thoſe tumors are cald *Bubones*.
G. The yard with the foreskinne, *penis cum præputio*.
H. The ſtones or Teſticles, with the cod or *ſcrotum*.
II. The ſhoulders *humeri* ὦμοι
KK The armes *Brachia*, βραχίονα.
L. The bowt of the arme, called *Gibber*, ἀγκών.
M. The outſide of the lower part of the arme cald *cubitus* πῆχυς.
N. The wreſt cald *Brachiale* κάρπος
O. The after-wreſt *poſtbrachiale*, μεταχάρπιον.
P. The Palme called *Palma* or *vola manus*, θέναρ.
φ The backe of the hand *Dorſum manus*, ὀπισθέναρ.
QQ. The fore and middle part of the thigh. where wee apply cuppingglaſſes to bring down womens courſes. μηρὸν.

RR. The knee, *genu*, γόνυ. SS. The Legg, *Tibia* κνήμη. TT. The calfe of the Leg *ſura*, γαστροκνήμιον. V V. The inſtep, *tarſus*. XX. The top of the foote *Dorſum pedis*, ῥῦθος ποδός. YY. The Inner Ankles, σφυρὰ. ZZ. The outwarde ankles. αα The toes of the feete. β The place vnder the inward ankle, where the veine called *Saphena* is opened.

The

The Second Table, shewing the outward backe parts of a Man.



A. The fore-part of the head, *Sinciput*, βρεγμά.
B. The top or crown of the head *vertex*, κορυφή.
C. The hinder-part of the head, *occiput*, κόρις ϗ ἰνίον.
From D. to D. The face, *Facies*, πρόσωπον.
E. The eyebrowes *supercilia*, ὀφρύες.
F. The vppen eye-lid, βλέφαρον.
*G. The tip of the nose cald *Globulus nasi*.
H. The back part of the neck, cald *cervix*, αὐχήν and the nuke or nape of the neck, there is a hollownes at the top of this *cervix*, where we apply Seatons.
I. The backe part of the shoulder top, called *axilla*, ὦμος.
KK The shoulder blades *scapulæ*, ὠμοπλάται.
1,2,3. On this place we set cupping glasses.
4,5,6,7. The backe *dorsum*, νῶτον.
8,9. The ridge, *spina dorsi*, ῥάχις.
L. The armehole, *ala*, μαχάλη.
* The elbow, *Gibber brachij*.
M M M M. The sides, *Latera*.
N N. The loines *Lumbi*, or the region of the kidneyes, ὀσφύες.
O O. The place of the hips, *coxendices*, where wee apply remedies for the Sciatica.
P. The place of the holy-bone, or *Os sacrum*, where we apply remedies in the diseases of the right gut.
Q. The place of the Rumpe or *Coccyx*.
R R The Buttockes *Nates*, κλῶνες.
S S. The backe parts of the thigh, *Femen*.
TT, The ham, *Poples*, ἰγνύς.
VV. The Calfe of the Leg, *sura*.
XX. The foote or *parvus pes*, πούς.
YY. The vtter ankle, *Malleolus externus*.
ZZ. The heele, *calx* or *calcaneus*, πτέρνα.
aa. The sole of the foote *Planta pedis*, κοῖλον τοῦ ποδός.
b The inside of the lower part of the arme called *Vlna*, ὠλένη.
c The outside of the same, *Cubitus* πυγών.
dd The wrest, *Carpus*.
ee The backe part of the hand, *dorsum manus*. *g*. The fore-finger *index* λείχανος. *h*, The thumb, *pollex*, ἀντίχειρ. *i*. The middle finger, *medius*, μέσος. *k*. The ring-finger *Annularis*, *medicus*, ἰατρικός. *l*, The little finger, *Auricularis*, *minimus*, ἐλίττης.

brest bone, behind with the backe: round about, on the outside, with many Muscles, on the inside with a Membrane which compasseth the ribbes. The third Region is called the lower belly, circumscribed aboue by the breast blade and the Midriffe: below, by the hip-bones, the Haunch bones and the share bones: behinde, by fiue racke bones of the loines, and the holy or great bone; and before, by the whole *Abdomen* or paunch. The rest of the body we call the Ioynts, in Latine *artus*, and those are the armes and the legges, which like boughes or branches, grow out of the trunke of the body. In the vpper region, are contained the Animal organs, that is, the braine, which is the seate of the soule, and the original or fountaine of sence and motion. In the middle region, are contained the vitall parts, and parts seruing for respiration, as the Heart, the Lungs, and the arteries. In the lower region are contained all the naturall organs seruing for concoction of nourishment, expurgation, of excrements and procreation. And therefore the vpper Region is called Animall, the middle Spirituall, and the lowest Naturall. The vpper is walled about on euery side with bones, as it were a strong bulwarke or peece for defence, because in it, the soule which is the Queene of this Little world, keepeth her residence or state. The middle is partly bony, and partly fleshy: bony, for the strength of the heart, and to frame the cauity; and fleshye, for the more facile motion of the Systole and Diastole. The lower region is before altogether fleshy, that it might better bee contracted and distended, and swell into a greater

The third region which is the belly.
The Ioynts.
What is contained in each region.
Why the vpper region is bonie.
Why the middle is partly bonie, and partly fleshie.
Why the lower is altogether fleshie.

proportion for the concoction of the aliment, in the ſuppreſsion of the excrements, & for the contayning and increaſe of the infant. In which poſition who can but admire the wonderfull prouidence of the Creator ? The Animall Region hee hath ſet in the higheſt place, as well for the conueniency of the ſences (for the voyce is better heard from aboue; the ſmell receiueth beſt an aſcending vapour, and the eyes which are as ſcout watches and ſpies, doe ſee furtheſt from aboue) as alſo becauſe it was conuenient that the principall faculties of the ſoule ſhould be as farre diſtant as they might frō the noyſome vapors which doe exhale from the partes where the aliment is concocted and the excrements are retayned.

Why the animal region is higheſt.

Why the ſpirituall region is in the midſt. Why the natural is placed below.

The ſpirituall Region, which is the well-ſpring of heate and ſource of life, is placed in the middeſt, that it might diſuſe his ſweet influence as well into the lower as into the vpper parts. The naturall Region as it were the kitchin, is built neere the ground, that the excrements might better ſettle from the more noble parts, and bee alſo more cleanly conuayed away. And this ſhall ſuffice for a briefe diuiſion of the whole body, and deſcription of the three regions, through all which we will walke at more leaſure, to obſerue the diuers parts therein contayned. But our perambulation ſhall not bee in an order anſwerable to the dignity of the parts, but rather Anatomicall. For they that diſſect dead bodies, doe firſt open the lower region, which becauſe it is the ſinke of the body, will ſooneſt bee corrupted vnleſſe the parts therein contayned be taken away. We therefore from it will commence our diſcourſe.

The order of diſſection.

The diuiſion of the inferior or lower belly. CHAP. II.

The ſcituatiō of the lower belly.

THE inferior or lower venter, which wee commonly call the Belly, in greeke γαστὴρ ; is almoſt the middle part of the bulke or trunke of the body, diſtinguiſhed from the cheſt by the *diaphragme* or midriffe ; and is circumſcribed or bounded aboue by the breaſt blade at the end of the breaſt bone, below, at the ſhare bone : before, by that which is properly called the *abdomen* or paunch. (for ſome call all the lower belly by that name, whence thoſe that are great gormandizers are ſayd to be *nati Abdomini*, that is, borne for their bellies) behind, by the ſpondels or rack bones of the loynes, and the ſacred or holy bone ; on both ſides, by the ribs the bones of the hippes and haunches. This Venter, becauſe it was to containe the members of generation & nutrition both, hath allotted vnto it the moſt ample cauity or hollownes of the whole body. It is therefore placed below, that it might better receiue the recrements or excrements of both concoctions, and more eaſily and cleanly conuay them away. Before and on both ſides it is fleſhy, that it might bee dilated or ſtretched out, as well for the receiuing of nouriſhment as for the contayning the increaſe of the wombe, or elſe bee compreſſed and ſtraightned when need ſhall bee for the excluſion or auoyding of excrements.

Why it is placed below. Why ſo fleſhy

It is deuided into two partes, the fore-part and the hinder-part ; The fore-parte which *Galen* calleth ἐπιγάστριον, and the Arabians (though their part of Anatomy wee may without great detrement to our Art forget) *Mirach*, *Galen* deuideth into three parts: The *Hypochondria*, the Region of the *Nauill*, and the Water-courſe or *Hypogaſtrium*: wherfore in imitation of him wee alſo wil deuide it into the Vpper, the Middle, and the Lower Regions.

How it is diuided. The forepart. The vpper part or region of the *Epigaſtrium*. *Hypochondria* why ſo called. *Præcordia* why ſo called. *Celſus*.

The Vpper, which is limited by the ſword-like cartilage or the breaſt-blade and the ends of the ribs, hath three parts ; two latterall or ſide-parts properly called *Hypochondria*, becauſe they are vnder the griſtles of the baſtard ribs, for ſo much the greeke worde ſignifieth. *Celſus* by a like kinde of notation calleth them *præcordia*, becauſe they bee vnder the mouth of the ſtomacke, which the ancient Greekes called by the ſame name with the hart. In the right *Hypochondrium* is placed the greater part of the Liuer ; in the left, the ſpleene and the greater part of the ſtomacke : the third part of the vpper *Epigaſtrium*, which alſo ſtandeth in the front, hath deſeruedly gotten the name of the whole, and is truely called *Epigaſtrium*, becauſe the ſtomacke lyeth vnder it, which by an excellency is called *Gaſter* or the belly. In this place is that cauity which the latter writers call *Scrobiculum cordis*, the hole or ſpoone of the Heart, the ancients called it *Cardia*. The middle part of the *Epigaſtrium* is the Region of the Nauill ; it is circumſcribed on both ſides, with the endes of the ribs ; & they right line of the haunch bone it hath likewiſe 3. parts : two laterall which *Galen* calleth κενεῶνας, *i.* void becauſe the place is without bones: & *Ariſtotle* λαγόνας, becauſe the are

What parts are in the *Hypochondria*. The 3. part of the vpper *Epigaſtrium*. The ſpoon or hole of the heart. The middle region of the *Epigaſtrium* called the region of the Nauil.

laxe

laxe and looſe; ſome call them *Ilia*, we call them the flankes. On the right ſide the blind gut, and a part of the Collicke gut, and a part of the empty gut called *ieiunum*. The third part of this middle Region of the *Epigaſtrium* is the front, where the Nauill is ſeated called ὀμφαλος, or *Vmbilicus*; this is the very center of the body, and vnder it lyeth almoſt all the empty gut. The parts cõtained in it.

Vnder this Region of the Nauill, is the lower Region and third part of the *Epigaſtrium*, and it reacheth as farre as the ſhare-bone. It beginneth at the ſpine or ſwelling of the vpper circumference of the haunch bone, and if you draw a line croſſe from either ſide vnto the middle ſpace betwixt the nauil & the ſpines or protuberations of the ſhare-bones, you haue the full extent of this *watercourſe*. Of ſome in a large ſignification it is called the little belly, but more ſtrictly they would haue it to be that part onely wherein the bladder is contayned, following as it ſhould ſeeme *Diocles Cariſtius*, who deuided the body into the head, the breaſt, the belly, and the bladder. This ſmall belly is diſtinguiſhed from the greater by a certaine fence or mound, made of the production of the *Peritoneum* or the rim: which production ſtretcheth from the necke of the bladder by the backe part, and the bottome thereof euen vnto the nauill, and this production is vpheld and ſuſtayned by three ligaments: two of which are called the *Vmbilicall* arteries, and the 3. is called *Vrachus*. This little belly *Hippoc.* calleth ὑπερον, and *Galen Hypogaſtrium*, the Latines *Aquaeductus*, becauſe the excrements haue in it their Rendevous or place of aſſembly: for in the fore-part it hath the bladder and the gut called *Ileon*, in the hinder part the right gutte, and betwixt theſe in women is the ſeate of the wombe. This little belly is alſo ſubdiuided into three parts, two laterall and a middle; the laterall reacheth to the place where the haire buds, and are called by *Celſus*, *Ilia*; becauſe they contayne the gut called *Ileon*, and the ſpermaticke veſſels; we call them the flankes. The middle or forepart reaching to the very yard, is properly called *Hypogaſtrium*; whoſe right and left partes which in the bending of the thigh, ſide or leane to the ſhare-bone, are called by *Ariſtotle Boubones* (which name thoſe tumors that ariſe in theſe parts doe yet retaine) by the Latines *Inguina*, which is with vs properly called the leske. The third and forepart of this *Hypogaſtrium*, where the haires growe tufted and ranke, is called by *Hippocrates* and *Ariſtotle* ἄβη, in Latin *Pecten* or *Pubes*, with vs the groine; yet *Pubes* doeth more properly ſignifie the Downe or Cotton when it ariſeth about thoſe parts in men, neare vppon the fourteenth yeare; in women about the twelfth; and it is a ſigne of maturity or ripeneſſe. For (that I may vſe *Hippocrates* wordes in his booke *de Nat. pueri*) aſſoone as the paſſages are open for the ſeede & monthly courſes; the hayre or downe in a boy or girle ſtarteth vp, the skinne being rarefied or made thin. Vnder theſe are the Priuities, called *Pudenda*; the very name carrying the remembrance of our ſhame and of our ſinne.

The lower region of the *Epigaſtrium* called the water courſe.

Diocles Cariſtius.

The Ligaments of it.

The names.

The parts cõtained in it.

The diuiſion of it.

The flanks.

The forepart.

Ariſtotle.

Boubones.

The leske.

Hippocrates.

Ariſtotle.

Th groyne.

Yeares of maturity.

Hippocrates.

Priuities.

The backe part of the lower belly.

The backe part of the inferiour Venter or lower belly, is limited by the end of the ribs, and the extemity of the rump-bone, this part ſome call λαγωμα, that is, *Cinctum*, the girdle-ſtead, giuing the name from the vpper part; or if you will *Subligaculum*, the breeches, for the greeke word will beare both, and then it taketh his name from the whole.

How it is diuided.

It is diuided into an vpper and an vnder part; the vpper is from the bending of the Backe vnto the Buttocks, which makes the Loynes, *Ariſtotle* calles them ὀσφύες; the fleſhy parts on either ſide are called in greeke φόαι, *Pulpa à palpando*, in imitation whereof wee call it the Fillet, as it were Feele it. On the right ſide, lies the right kidney, and on the left ſide, the left. Below the loynes are fleſhy and globous or round parts diuided by a fiſſure called by *Herophilus* διχάλα, by vs the *cleft*. *Ariſtotle* calleth them ἰσχια, becauſe they ſuſtain a man when he ſits, and we call it mannerly the *ſeate*: he calleth them alſo γλουτοὶ, in Latin *Nates*, *ab innitendo*, becauſe they ſerue in ſtead of quiſhions to ſit vppon, wee call them the buttocks. Betwixt theſe is the *Coccyx* or rump-bone, and vnder them as in a low valley, lie the very end of the right gut and the place of ſiege, the port eſquiline or the fundament.

Of the compoſition or frame of the lower belly. CHAP. III.

THE inferior or lower belly conſiſteth of two ſorts of parts; one called Continent or Contayning and inveſting parts, the other parts Contained. The inueſting or Contayning parts which properly make the *Abdomen*, (for they hide and conceale the bowels or entralles and the guttes ſcituated in this lower belly, called therefore of the greekes ἐπιγάστριον, that is, aboue the belly) are

Containing and contayned parts.

The common inveſting parts. The proper. are alſo of two ſorts, Common or Proper. The common, are the Cuticle or the curtaine or ſcarſe-skin; the true skin; the fat and the fleſhy membrane: for they encompaſſe all the whole body, excepting ſome particular parts, as we ſhall ſhew afterward. The proper inueſting parts are the Muſcles of the paunch, or of *Abdomen*; and the *peritoneum* or the Rim of the belly; for theſe are proper to the lower belly, euery venter hauing his proper inveſture vnder the common containing parts. And of theſe we will intreate in order, ſauing of the Muſcles, which wee will referre into their proper place, in the Booke of the Muſcles.

CHAP. IIII. *Of the Haires of the whole body.*

The names of haires. *Ariſt. 5. gener. Animal. 3.* THE haires in Greeke, are called τρίχες *quaſi* θέριχες, ὅτι θερίζονται, becauſe wee mowe or poule them. *Perſius* cals them *Cirri*, from the Greeke verbe κείρω, which ſignifieth to cut. In Latine they are called *Pili*. Almoſt euery liuing creature that ingendreth within it ſelfe is furniſhed with this couering, ſome more, ſome leſſe: and yet there are, which in ſtead of haires, haue prickes, as Hedge-hogges and Porcupines; others haue Feathers, as Birds (& therefore the ſauour of Feathers and haires when they are burnt are alike,) others Scales, as Fiſhes.

Haires and Feathers of a like ſubſtance

Whereof haires are ingendered. Haires are bodyes engendred out of a ſuperfluous excrement of the third concoction, torrified by the naturall heate; and they grow eſpecially where the skin is thinneſt & moſt temperate, and where there is for theyr nouriſhment ſome proportionable quantitie of moyſture. So that for their generation or production and their conſeruation, foure things are required. The heate for an efficient cauſe, the Matter, out of which they are generated or produced, a conuenient place for their production, and fit and competent nouriſhment, or rather apponed matter to be continuallie miniſtred for theyr preſeruation.

4. things required to the production of haires.

The matter. Remote. *Hip de nat. pueri.* The Matter of the haires is either remote, or more immediate. The remote matter is a ſuperfluous moyſture, which the kernels or *Glandules* which are diſpoſed in the ſobby and wateriſh places of the body could not ſucke vp; which moyſture therefore is thruſt out into the skin. Hence it is, that whereſoeuer there are any Kernels there are alſo haires: & verily *Hippocrates* in his Booke *de Glandulis*, aſsigneth the ſame profit vnto them both. The Glandules to receyue that matter which applyeth vnto them; the haires to gather it into their nouriſhment or for their production, being expelled by nature as a ſuperfluitie. So we ſee there are Glandules behinde the eares where alſo are haires, vnder the arme-pittes haires and Glandules; in like manner in the flankes and the groyne. And if in anie part there be Glandules and no hairs, *Hippocrates* in the place next aboue quoted, rendreth the reaſon, becauſe there is too great plenty of moyſture. For wee ſee that in ſobby and ſucken grounds ſeede will not take roote, nay the graſſe it ſelfe will not grow where the water ſtandeth continually.

In principio, where are Glandules, ther are hairs

Exception, & the Reaſon.

The immediate matter. *Galen.* The next and immediate matter of the haires, according to *Galen* in the fifte chapter of his ſecond Booke *de Temperamen*: is a ſooty, thicke and earthy vapour, which in the time of the third concoction, when the aliment is turned into true nouriſhment of the parts, is eleuated by the ſtrength of the action of naturall heate, and paſſeth thorough the pores of the skin.

Their efficient. The efficient cauſe is as we ſaide, a moderate action of the naturall heate, which exiccateth or drieth this moyſture or theſe ſootie and thicke vapours, and thruſteth them out by the tranſpirable paſſages of the skinne. For the vapour being thicke, in his paſſage leaueth ſome part of it ſelfe, to wit, the groſſeſt, in the very outlet where it is impacted, & by a ſucceeding vapour ariſing whēce the former did, is protruded or thruſt forward; and ſo one vapour continually ſolliciting and vrging another, they are wrought together into one body: euen as in chimneyes we ſee by the continuall aſcent of ſoote, long ſtrings of it are gathered as it were into a chaine. The difference is, that the ſtraitneſſe of the paſſages of the skin, where through the matter of the haires is auoyded, formeth them into a ſmall roundneſſe, euen as a wyre receyueth that proportion whereof the hole is, where through it is drawne.

The manner of their production. Compariſon.

A fit Compariſon. The manner of the out-gate of this matter, is thus. When by the continuall appulſion or arriuall of ſuch vapour to the skin, the pores are plenarily obſtructed, then the next vapour that ſtriueth to be at liberty, ſmiteth the former; which by reaſon of the ſtraitneſſe of the paſſage, is driuen out into the forme of a cord. He that would ſee an expreſſe image of this manner of production, let him reſort to a Glaſier, when he extendeth his mettall into the

guttered

guttered lead wherein he faſtneth his glaſſe, and he ſhall perceiue how the artiſt hath made an engine, whereby an inch of lead is driuen out into a foote of length. It was neceſſary therefore ſayth *Hippocrates* in his booke *de carnibus*, that this ſooty excrement ſhould haue a clammy or glewy ſubſtance, yet without any fatneſſe or greaſineſſe at all. Wherefore, whereſoeuer in the body, eſpecially in the outward parts, there gathereth together any ſuch glewy or clammy excrement, there the naturall heat bringeth forth haires; and this is the cauſe why in the arme-holes and about the priuy parts, yea and in all the reſt of the body haires growe plentifully. Now that part of the haire that is impacted in the pores of the skinne, may fittely bee reſembled to the roote of an hearbe ſticking in the ground, and that which beareth out of the skin, to the hearbe it ſelfe.

Hippocrates.

Comparison.

There is alſo required a conuenient place, as a foundation wherein the rootes of the haires may be eſtabliſhed, and that is the skinne, which of all other parts is fitteſt for their breeding, ſayth *Galen* in his firſt chapter of the ſecond booke *de Temperamentis*; becauſe it is neither too dry nor too moyſt; for as neither in Marriſh and Fenny ground, nor in one that is ouer dry and worne out of heart can any thing bee brought forth: ſo in an ouer moyſt or ouer dry skin no haire can grow. For though the skin be accounted dry, yet in a man it is not without ſome moyſture, as it is in thoſe creatures which are couered ouer with a ſtony or cruſty ſhell; as Oyſters, Lobſters, Crabs and ſuch like; and in ſuch as lurke in dennes, as Snakes; and thoſe that haue ſcales, as Fiſhes; in all which haire cannot grow, becauſe their skinnes are truely and altogether dry. Moreouer, the skin ought not to be too ſoft and moyſt, like Cheeſe new curded; for then it would not holde the rootes of the hayre becauſe of his thinnes; and beſide, after the pores were as it were bored by the excrement, they would fall together again, the parts being ſo fluid that they would run into one another and bee exquiſitely reunited: But moderately dry to hold the haire to his roote, and moderately hard, not vnlike a cheeſe already well gathered and ſomewhat preſſed, for ſo it would bee better thrilled and perforated by the iſſuing humour; which perforations alſo would remaine, the dry body not ſuffering the parts to reunite, but to conſiſt, and ſo by the continuall exiture of the matter, the pores would bee more fiſtulated. It muſt alſo be ſlack and thinne. Wherefore conſidering the whole skin is full of pores, whereout ſomthing is continually breathed by the naturall heate which diſperſeth, attenuateth, and carrieth away with it ſelfe no ſmall part of the inward moyſture, it followeth, that in all parts of the body the haires may iſſue forth, euery pore hauing a haire in it to keepe it open, for the better breathing or thruſting out of exhalations: yet we muſt except the skin of the palms and ſoales of the hands & feet, becauſe, as ſome ſay, in thē there is a large Tendon immediatly vnder the skin, which being exceeding thicke and dry, makes it vncapable of haires; but I cannot admitte of that reaſon, ſeeing a Hare hath alſo that broad tendon, and yet hath not thoſe parts voyde of haire. Therefore wee ſay that nature hath made thoſe partes haireleſſe, both for vſe that they might be the more ſenſible, as alſo for motion.

The conueniency of the place for hayres.

A dry skin admitteth not hayres.

Nor a ſoft.

But moderatly dry & thin.

Why there is no haire in the palmes & ſoales.

Now that the thinnes of the skin is required for the production of haires, it appeareth by the example of ſcarres; for if you raiſe a bliſter by ſcortching the vpper skin or cuticle, after it is healed, and the vpper skin is growne thicke no haire will riſe out of the ſcarre, becauſe it hath no pores in it.

Why haires grow not vpon ſcars.

The haires be of two kinds, ſome are συγγενικαὶ, that is, *congeniti*, bred with vs, as the haire of the head, of the eye-browes, of the eye-lids. Theſe are bred in the child while it is yet in the wombe, and are reſembled not vnto hearbes that grow by ſowing, but vnto ſuch plants as nature bringeth forth of her owne accord; and ſuch do not neceſſarily follow the temperature of the body.

2. kinds of haires.

Ariſt. 3. hiſt. Animal. 11.

Congeniti.

Other haires are called ὑστερογονεῖς, that is, *poſtgeniti*, bred after the skin is growne thin, which hapneth in Boyes when they beginne to breed ſeede, in Girles when their monthly courſes begin to flow; theſe come out in three places, anſwerable to the three places where nature bringeth forth the former kinde; Firſt about the priuities, ſecondly vnder the armeholes, thirdly in the chin and cheekes. Thoſe that are gelded before the age of foureteen yeares, haue no haires growing on their chinne: the reaſon is, becauſe the wayes of the ſeede are not opened, and by caſtration are after intercepted; and therefore the skinne doth not rarifie: if after thoſe haires be growne the Teſticles be taken away, thoſe haires alſo fall, excepting in the groyne. Againe, in women thoſe hayres which wee called *poſtgeniti* doe ariſe later, neuer in the chinne, becauſe there is not ſo great agitation of the humor in the act of generation in women as can rarifie the skin ſo farre from the place where the

Poſtgeniti.

How the haires fall in ſuch as are gelded.

Why women haue no berds

the ſeed is engendred; and yet wee ſee, that in ſome women after their Courſes are ſtaide, the haire begins to bud on their chins. It may alſo fall out, that both men and women may be without any of the *poſtgeniti* by ſome naturall defect, contracted in their generation.

The formes of the haires, and the cauſes of them. Their colours

The forme of the haires is expreſſed by certaine accidents; for they do vary in thickeneſſe and thinneſſe, hardneſſe and ſoftneſſe, length and ſhortneſſe, ſtreightneſſe and curledneſſe, multitude or ſcarſity, as alſo according to the quality of the skin, and the naturall propriety or condition of the parts in which they are fixed. Moreouer, they differ in colours, whiteneſſe and blackneſſe, and middle colours betweene them; ſo alſo by reaſon of age, and growth of the body. The chiefe cauſe of their thickneſſe and thinneſſe is the skin

The cauſes of their craſsitude.

ſaith *Ariſtotle*, 5. *gener. Animal.* c. which in ſome is thicke, and in others thin; in ſome rare, and in others thight and compact. Another cauſe is the variety of the moiſture lying vnder the skin, for in ſome it is clammy, in others wateriſh: ſo out of a thicke skin, thick & hard haire, and out of a thin skin, thin and ſlender haires are produced.

Of their length. The haires of the head are the longeſt.

And if the skin be rare and thicke, the haires are alſo thicke, by reaſon of the abundance of earthly ſubſtance, and the laxity of the paſſages. But if the skin be more thight and compact though it be thicke, they come out thin, by reaſon of the narrowneſſe of the paſſages. So if the vapour whereof they are bred be wateriſh, becauſe it is quickly dryed vppe, they growe not much in length; but if it bee clammy and glutinous, becauſe it is not eaſily dried vp, they ſpread themſelues in length. So that the cauſe of the length and ſhortneſſe of haires, is the abundance or ſcarſity of the humor wherewith they are fed. And hence it is, that the haires of the head are the longeſt of all the bodie, becauſe the Braine affoordeth a great deale of a clammy moyſture, and becauſe the braine is bigger then the other Glandules; they are alſo craſſe or thicke, becauſe the skin of the head is exceeding thicke, yet rare and containing much moiſture. The haires of the head in Latine, are called *Capilli, quaſi capitis pili*: in Greeke κόρση, from κείρω, which ſignifieth to cut. In men they are called *Cæſaries à frequẽti cæſione*, becauſe they are often cut: and in Women *Coma*, becauſe they beſtow great paines in combing and curling them. They are alſo in Woemen diuided by a line, which in Greeke is called λύσωμα, in Latine *diſcrimen*, in Engliſh the *ſhed*. Now the haire is either ſtraight or curled, eyther by reaſon of the exhalation it ſelfe, or of the pores whereout they paſſe. Of the exhalation the vvhich of being ſmoaky, by the heate and drought maketh the haire curled. For it hath a double courſe, the earthy and dry part downeward, the hot part vpwarde: hence it boweth not downe right, but wrinkingly, becauſe there is in it but little moiſture, & much dry and earthy matter; and this we may perceiue, if we parch haires in the Sun, or neare the fire: for the criſping of the haire is as it were a kinde of convulſion becauſe it wanteth moiſture: or elſe we may ſay, the haire curleth by reaſon of the drineſſe of the temper; and therefore all Black-Moores haue curled or criſped haire.

The names of the haires of the head.

The cauſes of the ſtreitneſſe or curling of the haire.

Of Curling.

By reaſon of the conſtitution of the pores wherein they are implanted. For when the exhalation is ſo weake, as that it cannot make a ſtraight way for it ſelfe, it giueth a forme to the pore anſwereable to it owne contortions. But if the exhalation bee ſtrong enough, yet it cannot aſcend directly vpwardes, by reaſon of the hardneſſe of the skin, then it turneth ſide-long, like as we ſee the ſmoake and the flame when it is hindred, to mount ſtreight vpwards, diuideth it ſelfe and turnes aſlant. Wherefore both by reaſon of the imbecility of the exhalation, and of the hardneſſe of the skin, the roots of the haires grow awry. Now it ſtandeth with good reaſon that they ſhould growe and continue ſtill ſuch as they were framed at the roote. For no hard or dry body can be extended ſtreight forth, vnleſſe it be firſt ſoftned and mollified.

Comparison.

Of ſtreight haires.

Thoſe that haue aboundance of moiſture, and the pores ſtreight, haue their haire alſo ſtreight. Againe, long haires are ſoft, but the curled are hard. Moreouer, haires encreaſe & grow more or leſſe according to the Nature of the skin, and the condition of the parts where they are implanted. In the head they grow in greateſt length and abundance, next in the Beard, becauſe that skin is moderately hot & dry, eſpecially when the haires are fine and ſlender. But the haires of the eye-browes and of the eye-lids, are ſmal and grow not almoſt at all: but for the moſt part, keep alwayes an equall magnitude, and ſeldome fall, becauſe they haue vnder them a hard body, like vnto a griſtle. For thoſe haires that ſpring from ſoft and moderately moyſt parts, encreaſe very much, as thoſe of the head and the beard; and *Galen* addeth thoſe of the arme-pits, and about the priuities: but thoſe that ariſe out of hard and dry places, are ſmall and almoſt of no growth: yet in ſome the eye-

browes

browes grow ſo hairy in olde age, as that they are conſtrained to cut them, or elſe they would offend their eyes. Haire buddeth in the chin, when the skin beginneth to rarifie or grow thin; the matter of it is a moyſture ſent thither from the head, as *Hippocrates* holdeth in his Booke *de Natura pueri*, and theſe haires make the Beard, which is not alike in euery man; for ſome about their chin and lips haue great ſtore of haire, ſome haue no haire there, but very much on their cheekes. The Beard.

Ariſtotle in the third Booke *de Hiſtor. Animal.* the 11. chapter ſaith, that the haires vſe to grow extraordinarily in ſome diſeaſes, eſpecially in conſumptions; hee addeth alſo, in old bodies and dead corpes they receiue augmentation both in length and thickneſſe, but do not ſpring anew.

They varie likewiſe in colour, and are anſwerable to the predominant humor, for ſuch as the humor is which the fleſh draweth vnto it (ſaith *Hippocrates*,) ſuch alſo is the colour of the haire. The cauſes of the colours of the haires. *Hippocrates.* *De Nat pueri.*

Galen in his ſecond Booke *de Temperamentis*, and the fift Chapter, ſaith, that the haire becomes blacke, when the vaporous excrement ſcorched by the heate is changed into a perfect ſoote; and ſomewhat red, when the excrement impacted in the paſſage is not yet altogether growne black; but yellow, when the vapour is leſſe ſcorched; for the excrement that is ſo impacted, proceedeth of yellow and not of blacke Choller. White haires are made of Flegme, and the colours betwixt theſe of a mixture of Flegme and choller. The humour, *Galen.* When Black. Reddiſh. White.

But a queſtion may be asked, why in Beaſtes the colour of the haire followeth the colour of the skinne; and in men it is far otherwiſe; far the whiteſt men and women, haue often haire coale blacke. *Ariſtotle* maketh anſwere 5. *de generatione Animal.* 3. and 3. *Hiſtor.* 11. Becauſe, ſayth hee, a mans skin is thinner then the skin of any other Creatures of his magnitude; and therefore the skinne cannot affoord any matter of haire of it ſelfe, or reteyne the excrement driuen to it ſo long as to giue it his owne colour. Why mens haires arenot of the colour of their skin.

The haire varyeth alſo by reaſon of the region and the diuerſe diſpoſitions of the ambient ayre; ſo thoſe that inhabite a hotte and dry country, haue hard, blacke, dry curled and brittle haire, and of ſmall growth, as the Egyptians, Arabians and Indians: contrariwiſe thoſe that inhabit in a moyſt and cold climate haue ſoft haires which grow moderatly, are ſmall or fine, ſtraight and reddiſh, as the Illirians, Germans, Sarmatians and all the coaſt of Scythia, as *Galen* ſayth. But ſuch as inhabit a temperate tract betweene theſe, haue hayre of greater growth, exceeding ſtrong and ſomewhat blacke, moderately thicke, neither altogether curled, nor altogether ſtraight. The Region.

They vary alſo by reaſon of age; for little children haue little haire, becauſe as yet their skin hath no pores, nor any ſootie excrement applying vnto it: when they beginne to cotten, which is about xii. and xiiii. yeares of age, their haires are ſmall and weake; but as their youth growes ſtrong, and their flouriſhes grow vpon them, which is towards xv. & xviii. then their haires grow many, great and ſtrong, as well becauſe their skin is growne full of pores, as alſo for that they abound with ſootie excrements. How haires alter acording to ages.

Thoſe that are well in yeares haue hard haire, becauſe their skin becomes hard & thicke in old age, by reaſon of their coldneſſe and ſiccity. So we ſee ſome men when they grow in yeares, become bald eyther for want of hot and clammy moiſture, or becauſe naturally and originally their skin was ſomewhat too dry, or elſe as *Hippocrates* ſaith, becauſe they abound with Flegme, which being ſtirred in their heads by carnall copulation, and ſo growing hot; when it ariſes into the skin, it ſcorcheth the rootes of the haire and ſo cauſeth them to fall off; and that is the reaſon, why neyther Eunuches nor children vſe to growe balde. Now this baldneſſe begins commonly in the forepart of the head, becauſe (ſaieth *Ariſtotle* 5. *generat. Animal.* 3.) it is dryeſt, for there the skin lyeth vpon the bare bone, without any interpoſition of fat, as it is in the Nowle. *Hippocrates* *De Nat. pueri.* The reaſon of baldneſſe.

In like manner, Men growing olde become gray-headed; not by reaſon of drought, for we ſee often that many haires become gray together, but nothing can vpon a ſuddaine become dry: the true cauſe is putrifaction for want of ventilation, and therefore thoſe that haue their heads continually couered, grow ſooner hoary then others, as *Ariſtotle* obſerued. *Galen* in his ſecond Booke *de Temperam.* and the 5. chapter, ſaith, that before the skin of the head is growne to extreame drineſſe, the haires become weak for want of conuenient foode, and white becauſe the nouriſhment wherewith they are fed, is as it were the dregges of Flegme, which in proceſſe of time remaining about the skin, do putrifie. Why old men grow gray. 3. *Hiſt. Animal.*

Of all parts the Temples are firſt hairy, becauſe they are very moyſt by reaſon of the great

great Muſcles which lye vnder them. Now euery Muſcle is fleſhy, and fleſh is moyſter then eyther bone or skin. Next vnto them, the forepart of the head growes white; laſt of all, the haire about the priuities and the eye-lids; but no body growes bald in the temples or in the hinder part or nowle of the head.

How haires are nouriſhed

The haires are fed by moyſture, therefore *Hippocrates* ſaith, they grow moſt plentifully where they finde moderate moyſture for their foode, which *Ariſtotle* ſaith, is diſpoſed at their roote; for if you plucke them vp, that moyſture is drawne vp with them: beſides, the haire is thicker at the roote then in the reſt of his length, becauſe it hath ſome of that moiſture newly applyed to it. From theſe humors are exhalations raiſed, and nature turnes the thickeſt and clammieſt of the excrements, into the nouriſhment of the haires. Therefore when they are well fed, and with lawdable aliment, they encreaſe apace, and are moderately craſſe or thicke. But when they are cut, they do not beginne to grow vp againe where the Sheeres diuided them, but at the root, from whence they iſſue, and ſo they encreaſe and are nouriſhed by appoſition, as the teeth are; not by the excrements of faultie and vicious humors, but by excrements of the third concoction: otherwiſe, they would not fall off, but rather encreaſe in thoſe that haue the French diſeaſe and the Leproſy, conſidering that in ſuch bodies the Excrements of vicious humours are exceeding aboundant.

The vſes of the haires.

The vſe of haires in generall is foure-fould. Firſt for a couer; ſecondly for a defence; thirdly for an ornament vnto the partes vnder them; fourthly to conſume and waſte away the thicke and *fuliginous* or ſooty excrements. So the haires of the head which are in great aboundance, (for of all creatures a man hath moſt haire on his head) do couer the braine, and ſhelter it from ouer much cold or heate. For mans braine being in proportion greater and moyſter then any other creatures, it requireth accordingly a more carefull guarde and preſeruation; for that which is the moyſteſt will moſt eaſily grow hot and cold againe. And becauſe the brain is ſeated farre from the fountaine of heat, and neare vnto the bones, and vnder them is not couered with any fatneſſe; the haires are prouided both to fence it, and to keepe it warm. They alſo waſte and conſume the thicker excrements; and becauſe it is not behoofefull for vs that wee keepe our heades alike couered in all ages of our life, times of the yeare, countries and conſtitutions of bodies; therefore we may fit our ſelues vnto the times, & weare them either longer or ſhorter; but if they be altogether ſhauen off, they proue the cauſe of defluxions. The haires of the head haue not onely this vſe to couer the cheekes and chinne (which women doe with veiles and maskes) but alſo they ſerue for ornament. For it is a venerable ſight to ſee a man when he is come to the yeares fit for it, to haue his face compaſſed about with thicke and comely haire. Nature therefore hath made the vpper part of the cheek and the noſe without haire, leaſt the whole face ſhould be wilde and fearce, vnbeſeeming a milde and ſociable creature ſuch as a man is. In women the ſmoothneſſe of their face is their proper ornament; they needed no enſigne of maieſty becauſe they were borne to ſubiection. And Nature hath giuen them ſuch a form of body as is anſwerable to the diſpoſition of their minde. To conclude, the vſe of hayre is diuers, according to the ſeuerall places where they are: as for example, the haire of the eye-browes ſerue for to receiue the humour falling downe from the head, and thoſe of the eye-lids to direct the ſight, and ſo of the reſt.

Man more braine then any other creature.

Of the Cuticle or Skarfe-skin. CHAP. V.

How it is generated.

THE firſt contayning or inueſting part, is the Cuticle, which the Greekes call *Epidermis*, becauſe it runnes vppon the ſurface of the true skinne; whereof it is as it were a flowring or creamy production. For whileſt Nature in the generation of the skin mingleth bloud with the ſeede, a moyſt vapour of the bloud foaming or frothing vp, and driuen forth by the ſtrength of the heate, is condenſed or thickned by the coldneſſe of the ayre, and turned into the Cuticle or skarf-skin, for ſo I thinke wee may properly call it. And this is the reaſon why in Infants newborne, the whole skin looketh red, the Cuticle not being yet formed for want of cold ayre; or at leaſt not ſufficiently condenſed, as it is after a ſhort time; the aire thickning the cream or froth of the bloud, as wee ſee in gruell or boyling of paſte or ſtarch, a skin, filme or phlegme gathered together of the vaporous froth that ariſeth from the thicke moyſture which is by the cold ayre condenſed.

Why Infants looke red.

This

This Skarfe-skinne is easily lost by attrition or scalding, and riseth apparantly from the skinne; it is likewise as easily recouered where the skin remayneth sound (for where there is no skin, but onely a scarre or cicatrice, there it will not growe againe) and therefore it is no spermaticall part, because if they perish, they cannot or very hardly againe be restored. It wil not grow vpon a scarre.

It is wondrous thin (vnlesse it growe *Callus* or hard by continuall labour, as wee see it doth in Felt-makers) that it should not dull the sence of the skin vnder it: yet in the palmes of the hands, and the soales of the feete, where it is continually worne and renued againe, it is more crasse and thick. This is that which Serpents cast euery yeare, we call it the slough; men neuer, but vpon long sickneſse or poysons, or the vse of slabbering complexions. It is thighter or more compact then the skin it selfe, whence it is, that those watery humours which are thrust out from the Center to the Circumference of the body, doe easily passe through the skin, but hang often in the Cuticle, and generate *Ecthymata*, *Phlyctides*, and those many waterish Pustles which are called *hydrea*. It is altogether without bloud, because it receiueth neither veine nor arterie, so that it encreaseth rather by a kind of addition of matter, then by Nutrition. Why thin. The slough of a snake. The thighines of it manifested. The reason of pustles in the body.

Insensible it is, that it might defend the skinne vnder it from externall iniuries; as also attemper the exquisite sense of the same, and so becommeth *medium tactus*, the *meane of touching*. For sayth *Aristotle*, all sensation is made by some *Meane*, none by the immediat touch of the obiect and the instrument. Hence it is that a man cannot see to reade vpon a booke that is layd vpon his eye; because there wanteth the meane betweene the obiect and the instrument of sense, that is, ayre enlightned. In like manner when the Cuticle is off, we cannot distinguish between one Temper and another; because the very gentlest touch of the bared skin breedeth paine, and the sensation is confused, which is distinct when the skarfe-skin is whole. The vses of the skarfe-skin. *Medium tactus. Lib. 1. de Anim. Text. 114.*

There is also another vse of it, to couer the open ends of the *Capillarie* or hairy veines which doe determine in the skin: for if the Cuticle be taken off, the skin vnder doth bleed. Moreouer it is also a couering to the skinne, that the moisture might not indecently or vnprofitably well or issue out at all times; for in a gall or rub, which is called *Intertrigo* in which the Cuticle is separated, the skinne is euer moyst.

Lastly, it smootheth and polisheth the roughnesse and inequality of the skin, making it soft, supple and slicke, and so becommeth one of the greatest beauties that nature hath giuen to the body of man. That I cannot but wonder at *Columbus*, who vtterly forgot the manifold vses of this Cuticle.

Of the Skinne. CHAP. VI.

VNder this Curtain or Skarfe, lieth the true & genuine skin which the Greeks call δέρας, becausе it may bee excoriated or flayed off, so *Hippocrates* in his booke *de Arte*: but in his book *de insomnijs*, γρῶμα; and *de victus ratione in acutis*, φοίνιν; and *de ossiũ Natura*, δέρμα *quasi* δέσμα a band, because it compasseth and knitteth together the whole body; in Latine it is called *Cutis*. It hath a substance proper to it selfe, although it bee very like to a sinew and membrane, because it is white, will stretch, and is of exquisite sence; but it is thicker then any membrane. It is ingendred of seede perfectly mixed with bloud, whence it commeth to passe that by it wee may iudge as well of the spermaticall as of the bloudy parts. It seemeth therefore to be of a middle nature betwixt flesh and a sinew, and so *Vesalius* conceiued it, not so abounding with bloud as flesh, but as it were a bloudy sinew: so sayth *Galen* in his first booke *de Temperam.* Notwithstanding in the composition the spermatical part exceedeth the sanguine, which appeareth as by the colour, so by this, that being wounded it is only reunited or conioyned by a cicatrice or scarre. *Columbus* thought it was bred of the extremities or ends of the vessels dilated; *Varolius*, onely of the softer sinewes, which attayning to the surface of the body, doe there growe together into a couering, receiuing addition from the affluence of bloud; as the broade leaues of water Lillies arising from a slender stemme, when they appeare aboue the water, are extended into a great bredth out of a small stalke. *Galen* in the third of his Method, sayeth it is bred of the dryed and constringed or writhen flesh vnder it; and that is the reason why no hayres will grow vppon scarres, because they haue no foundation for them as the true skinne hath: but it should seeme that heerein *Galen*, and not he only, but *Plato* and *Aristotle* were somewhat mistaken: for the skinne may be flayed The names of the skin. His substance. Whereof it is made. *Vesalius. Gal. 11. Columbus. Varolius. Plato. Aristotle.*

from

from the fleſh vnder it, yea and betweene the skin and the fleſh there are two partes (if at leaſt they may be ſo called) the fat and the fleſhy Membrane.

The colour followeth the humor.

The skin is naturally white, but according to the humours that abound, or the bodyes vnder it, ſaith *Hippocrates* in his Booke *de ſuccis*, it varieth the colour. For example: where blood aboundeth and the skin is thin as in the face, there a roſie redneſſe mingleth it ſelfe with the white, or ouercommeth it, eſpecially if eyther by heate or motion of the minde it flowe to the place more plentifully; and this blood when it is condenſed or thickned by cold, maketh the skin looke liuid or blew. In Chollericke men the skin is pallid or yellowiſh: in Melancholy ſwarty and blackiſh or duskiſh, but if it bee defiled with vitiated Humors, it becommeth yellow and black in the Iaundiſe and Morphew.

It altereth alſo his colour, by reaſon of bodies vnder it; ſo where it adhereth or cleaueth to the fleſh, as in the bals of the Cheekes and Palmes of the handes, it ſooner becommeth red; if to the fat, it is whiter and ſmoother, eſpecially where the fat is more plentifull; but when that fat is conſumed, the skin becommeth wrinkled and looketh like a duskiſh ſhadow; as alſo it is liuid or blewiſh where the greater Veines are branched vnder it. Furthermore, the skin that it might be a kinde of muniment or defence is thicke, though not ſo thicke as in other creatures. It cannot without extreame paine bee ſeparated from the fleſh, becauſe the extreamities or ends of the veſſels do determine in it; whence ſome haue thought, that it proceedeth from thoſe extreamities of the veſſels dilated or ſpread into a ſuperficies or ſmooth plainneſſe. It is ſoft and of exquiſite ſenſe, by which it forewarneth the inward parts of the approaching euill before it ouertake them.

What parts of the skin are thin & thick.

According to the diuers vſe of the parts, it is either ſofter and thinner, as in the face, the yard, and the *ſcrotum* or cod; or harder, as in the necke, the backe, the legs, and the ſoles of the feete; ſome of it is in a middle temper betweene hard and ſoft, as in the palme of the hand, and eſpecially in the fingers ends, becauſe they are ordained to apprehend with; and beſide in the skin of the hand, the power or ſenſe of feeling was to be perfect, and therefore it behooued that it ſhould bee voide of all exceſſe, and moſt temperate of all others; becauſe that which is the iudge of feeling as all other Inſtruments, muſt be free from any forreigne or externall quality whereby the iudgement might be preiudiced: So ſome part of the skin is exceeding thicke, as in the head; ſome part onely thicke, as in the necke; ſome part thin, as in the ſides and ſoales of the feete, which is the reaſon that there men are tickliſh, ſome part yet thinner, as in the palme of the hand; and ſome thinneſt of all, as in the lippes.

The connexion of the skin

It hath alſo a diuers connexion to diuers parts: for ſomewhere it may bee eaſily ſeparated, as in the vpper and middle venter, the armes and the legges; otherwhere very hardly, becauſe of the fleſhy Membrane to which it is tied by the mediation of certaine Fibres & veſſels, betweene which and the ſaide Membrane, the fat where it is, ſo interpoſeth it ſelfe, that the skin may more eaſily be flayed from it: but from ſome parts it can hardly or not at all be ſeparated, as from the ſoales of the feete, and the palmes of the hand, to which it is immediately conioyned, that the apprehenſion of thoſe parts may be more firme and ſtable. It is alſo very hardly ſeparated from the fleſh of the fore-head, & almoſt of the whole face, eſpecially of the eares and lippes, becauſe of Tendons and Muſcles; eſpecially that which they call the *broad Muſcle* mingled therewith. Finally, in the forehead it is mooueable, in the reſt of the body (of a man I meane) immooueable, or for the moſt part. for in Beaſts it is almoſt alwayes mooueable, and they ſay, an Elephant can by the corrugation or wrinkling of his skinne, kill the flies that moleſt him.

Where the fat interpoſeth it maketh the skin more eaſie to flay.

Where the skin is moueable.

It is an vnſeamed garment couering the whole bodie, yet hath it certaine breaches made by Nature for her eaſe and reliefe, partly manifeſt, which are not many, and are called *Foramina* or outlets; partly inſenſible, which are infinite, called *pori*, & of vs pores. Al which ſerue either for receyuing in or letting out, or both as neede ſhall require.

The paſſages of the skinne.

The *Foramina* or paſſages and outlets are theſe: about the eyes for the help of the ſight, the thwart holes of the eye-brows; about the eares for the hearing, that as well the diuerſities of ſounds might be let in, as alſo the excrements or waxe of the eares be auoided out; about the Noſethrils for a helpe to reſpiration and to ſmelling, and the conueying away of the mucous or ſlimy excrement of the Braine: the mouth is open to receyue meates and drinkes, and ſometime againe to vomit. The nipples of the breaſt ought neceſſarily to be perforated, that by them the Infant might ſucke milke from the Mother: the nut of the yard for the emiſsion of ſeede and vrine; the port *Eſquiline* or ſiege, that the noyſome excre-

The paſſages or outlets of the skin.

crements may be conuayed out of the body. In women the *lap* of the wombe, as well for the admiſsion of the part of generation, as for the bringing the Infant into the world, and to auoyde the vrine and the monthly courſes. In the Infant the nauill that it might receiue bloud and ſpirits to ſupply it with nouriſhment and life. Finally, the fingers endes where the nayles are affixed it is alſo perforated, out of all which parts we haue knowne bloud to iſſue in a cruell diſeaſe.

The pores are aboundant like to the pin-hoales of a ſyue or ſearce, as is manifeſt by the ſweate and hayre that breathes and breakes out (in which regard *Plato* compares it to a fiſh net:) and theſe parts are the way of tranſpiration, that the excrements of the third concoction which haue no other, might this way haue egreſſe or auoydance; whence of ſome it is cãlled the vniuerſall *Emunctorie* or draught, becauſe it receiueth all the ſuperfluities of the inward parts. Theſe pores are ſmall and almoſt inſenſible, leaſt otherwiſe there ſhould be too free a diſsipation of the ſpirits, yet in ſome bodies they are narrower or ſtreighter, in ſome wider, and ſuch doe eaſily melt away in ſweat, and are leſſe affected with inward cauſes: the other ſweat very difficultly, and becauſe the excrements are retayned, doe eaſily incurre diſeaſes thereby.

The pores.

Tranſpiration

That theſe pores may bee kept open, Nature hath aſsigned to euery one a haire (of which we ſhall ſpeake by and by) which is faſtned in the pore with a ſlimy white roote, excepting thoſe places where they are continually worne off, as in the palmes of the handes. Theſe pores are the cauſe that the *Bands* in ſome deligations become bloudy, and ſometime pure bloud hath auoided by them, as in the Engliſh ſweate: by theſe alſo ſome thinke the ſpirits doe powre themſelues forth in profuſe ioy, and the more liberall vſe of Saffron and other Diaphoreticke or ſweating medicines, by both which they are exceedingly relaxed.

Why the haires are ſet in the Cuticle.

How the bãds or tyes in deligatories of parts become bloudy.

That this Skinne may be nouriſhed, that it may liue and haue ſence, it receiueth all theſe three common Organs or inſtruments of nouriſhment, life and ſence, veines, arteries, and ſinewes; whoſe diuarications and diuers branchings, wee ſhall ſhew in fitter place in our diſcourſe of the veſſels.

The vſes of the skin, and firſt that it ſhould bee the immediate inſtrument of outward touching, that we might be forewarned of outward iniuries before they come to hurt the inward partes; like as the Membranes are the Organs of inward touching or ſenſation. Moreouer, it is ordained to be the common and natiue Veſtment or Mantle of the whole body; a muniment beſide and a comely ornament compaſsing and couering it on all ſides, that the veſſels might more ſecurely runne vnder it: the muſcles and entrals be contayned in their proper places, and defended from heate and colde, and the naturall heate deteined from ouer free effluxion.

CHAP. VII. *Of the Fat.*

THE Fat called in Greeke πιμελῆ, in Latin *Pinguedo*, in man is bedded betwixt the skinne and the fleſhy membrane, but in beaſtes it is vnder the membrane alſo. It is ingendered of the more oylie, thinne, and ayrie portion of pure and abſolutely laboured and concocted bloud, diſtilling like a dew out of the ſmal and capillarie veines of the habite of the body: which bloude is curdled by a moderate heate (for a burning heate would conſume it, and a weake heat would not concoct it) and the denſity or faſtnes of the membrane; which is the reaſon that beaſtes grow fatteſt in winter when their skins are more condenſed with the cold.

The Fat, wher of ingendred.

This membrane is neruous, thin, and very faſt or thight, and vnder the skin incloſeth all the body, that all that oylie matter rarified into vapors, which ſlippeth by the inward mẽbranes, may light vpon and cleaue vnto this, and ſo be turned into fat, that nothing profitable might be loſt. The manner of this worke of Nature wee haue in diſtillations, where though the Stil-head be very hot, yet becauſe of his ſadneſſe or denſity, the vapours which were rayſed vp by the heate of the fire are thickned into water.

The Fat of a man is leſſe white then of any other creature; yet the white membranes by which the bloud which is his matter paſſeth, do alter it ſomewhat, ſo that it becommeth often yellower then white.

There be ſome parts, there be alſo ſome ages which want this Fat; for thoſe parts whoſe bending and extenſion it might annoy, are better without it, as the membranes of the

What parts & what ages haue leaſt Fat.

Braine, the Eye-browes, the Yarde, the Cod and the Stones, or Teſticles: whereuppon ſome haue excluded it out of the number of the Contayning or Inueſting parts. In thoſe parts where it is, it differeth in hardneſſe and ſoftneſſe; for in parts that are to be mooued more violently, it is harder and wouen with Fibres and ſmall veines, as wee ſee in the tallow of beaſtes; as in the palme of the hand, the inſide of the fingers endes (where there is more neede of it to moyſten the manifold tendons and veſſels that there are gathered, to fill vp the empty ſpaces and make the skin more euen and equall for better apprehenſion) the ſoale of the foot eſpecially in the heele, that we might more ſteadily reſt vpon it. Sometimes it is alone; ſometimes together with a craſsie and ſlimy humor, which ſtands in ſtead of tallow to fit the parts better for motion, and to hinder their exſiccation or drying.

Where it is hard & where ſoft.

In other parts it is ſofter and yellowiſh; ſo it is very ſparingly affixed to the out-ſides of the hands and feete; in the buttockes becauſe there is more vſe of it, it is more copious or plentifull. In cold and moyſt bodies, as in Men and Hogges it is aboundant (whence *Galen* ſayth that a woman is fatter then a man) as alſo in them that leade an idle and ſedentarie life. In hot and dry, as Apes and Hounds, it is either none at all or of no quantity. In new borne creatures none at all; in thoſe that are conſumed with famine, with diſeaſe, or with age very little.

Lib. 14. vſe partium.

This Fat which in horned beaſtes is called *Seame*, in Swine *Lard*, differeth from the *Greaſe* which in Greeke is called στέαρ, in Latine *Adeps*, as *Ariſtotle* and *Galen* teach; becauſe this Fat is ſofter and moyſter, and is eaſily melted, and being melted doeth not eaſily clod togethet againe; but the *adeps* or greaſe is harder and dryer, not ſo eaſily melted, and ſuddenly congealed againe, and therefore is more plentifull in thoſe creatures whoſe natures are altogether earthy and dry, and thoſe that are more moyſt haue aboundance of the fat we call *pinguedo*. Men haue much of this fat vnder their skin, becauſe the matter of it is retayned by the ſolidity and thickneſſe of rhe ſame, for ſo wee ſee that thoſe creatures that haue the faſteſt skins are the fatteſt, as Swine and Dolphins. Now the *adeps* or greaſe in a Man is in his Kall, Kidneyes, Heart, Eyes, the ioyntes of the Bones, betwixt the broade Tendon and the Skin of the middle of the palm of the handes, in the inſide of the Fingers and the Toes.

The differences of fats. 3. *Hiſto. Anim.* 17. *lib.* 3 *de facult. aliment.* 11

Where *adeps* is in men.

The Vſes of this Fatte are: Firſt it is a defence to the parts to which it is allowed, ſo in the Buttocks it ſerueth vs inſtead of a quiſhion; in other partes it auaileth much towardes their naturall poſition and free motion, and therefore in thoſe that be fat indeede, it lyneth the in-ſide of the muſcles as we ſee in fat Beefes. For the veſſels which runne vnto the skin it is a ſoft pillow, ſo ſafe-guarding and moyſtning them, that they bee not dryed, and ſo diſtende or lying bare be broken in peeces; and therefore it is gathered plentifully in thoſe parts where the larger veſſels deuide themſelues.

The vſes of the fat.

Another Vſe of it is to fill vp the empty diſtances betwixt the muſcles, veſſels, and the skin, that ſo the body might be plump, equall, ſoft, white and beautifull. Moreouer it ſerueth for a light couering to warme the body and to cheriſh the naturall heate, prohibiting the effluxion of it by his viſciditie or ſlimineſſe, and by his thicknes cloſing the pores, that neither in winter the cold ſhould too freely enter, nor in ſummer the heat too frankly evaporate. Finally ſayth *Galen* in his fourth Booke *de vſu partium*, and the 11. Chapter, in great famines and want of ſuſtenance, it is conuerted into Aliment, and becommeth the Fother whereon the naturall heate relieueth it ſelfe. For being diſſolued it acquireth the forme of a bloud-like vapor which returneth into the veines, and ſo becommeth for want of better, a ſubſidiarie nouriſhment of the partes. The vſe of the greaſe is to moyſten and ſupple the hotte and drie parts, as the Heart, to make the motion more glib and agile, and to keepe the ioynts of the greater bones and the out-ſide of ſome Ligaments from being exiccated, as alſo the ends of the griſtles.

The vſes of *Adeps*.

Of the fleſhy Membrane. CHAP. VIII.

The fleſhy membrane.

THe fleſhy Membrane (firſt ſo called by the Arabians) or Pannicle, called *Panniculus Carnoſus*, in Greeke ὑμὴν σαρκώδης; is onely fleſhy among all the membranes, and that eſpecially in Beaſtes. *Galen* calles it ὑμήν, that is, a membrane; ſome call it the muſculous Membrane, becauſe in thoſe creatures which mooue their whole skinne, it is ſo ſprinkled with fleſhy Fibres, that it ſeemes indeed to be a muſcle.

This

The Third and Fourth Table shew the Skin-Veines which are opened and scarified: the third those on the Fore-side, the fourth those on the Backe-side: which Veines are for the most parts alike in every body, especially those that vse to be opened.

TABVLA. 3.

TABVLA 4.

a 1, 2. The outward iugular veine climing vp the sides of the necke, this can hardly be opened without daunger, but his braunches may bee scarified in the necke.

b. 1. The place where this veine is deuided into 2. branches.

c. 1. The inner branch of the exterior iugular, which going to the muscles of the mouth and the bone *Hyoss* is couched vnder the toung, where it is opned in squinsies and other diseases of those parts.

d. 1. 2. The vtter branch of the same externall iugular that goeth to the back-part of the head

e, 1. Braunches going to the *bucca* or chuck and the nose.

f, 1, 2. The fore-head veine, which in the middle of the fore-head where it is wont to be opened, is ioyned with the braunch of the same veine on the other side.

g. 2. The veine called *vena puppis*.

h. 2. Veines dispersed along the Temples, to which are adioyned a portion of the fore head veine.

i, 1, 2. The veine which goeth to the eares, and watereth the back part of the head.

k, 1. A branch comming from the vpper part of the axillary veine, and going to the more backeward muscles of the necke.

l, 1, 2. A branch from the *Caphalica* or head veine, going to the skin and the muscles which lift vp the arme.

mm. 1. m. 2. The *Cephalique* head or vtter-veine, which passing along the vtter part of the arm, accompanied with a nerue, and is opened commonly at the vpper bunch of the bought of the arme, but happely it might more safely bee opened a little lower wher it bendeth from the sinew.

n, 1. Smal veines from the *Cephalica* dispersed through the skin of the arme.

o. 2. Branches from the head veine to the shoulder blade, carried between the skin and the flesh.

p, 1. The *Cephalica* is here diuided into 3. branches.

q. 1. The first of these branches which goeth to the muscles, arising frō the vtter bunch or knot of the vpper part of the arme called *humerus*.

r, 1, 2. The second of them, which in the bought of the arme is ioyned with a branch of the liuer veine and their coniunction is marked with the figure 3.

s, 1, 2. The third is carried side-along aboue the *radius* and the vpper part of the arme bestowing branches vppon the skin, the chiefest of which neere the bought of the arme runneth outward, but turnes ouer neere the wrest, and there meeteth with the Liuer-vein, marked there in the second figure with 2* and a little lower being diuersly deuided nourisheth almost the whole hand

tt. 1. The Liuer veine called *Hepatica, Basilica* or the internall veine it is called of some, & in the left arme *Lienaris* or the spleene-veine.

u, 1 A braunch from the Liuer-veine deuided into two, nourishing the skinne within and without.

x. 2. A branch going to the muscles of the vpper arme, and the skin on the vtter side.

y, 1. The fore branch of the Liuer vein, which at the bought of the arme is ioyned with a braunch of the *Cephalica* marked with r, which two branches make the middle vein named *Mediana*, noted with 3.

* 2. A braunch arising from the former, and passing to the wrest, and on the after wrest meeteth with a braunch of the *Cephalica* which are ioyned aboue the little finger, which coniunction we noted in saboue.

z, 3 *m* Two fore veines of the *Cubite* or lower arme from a braunche of the Liuer veine, which being accompanied with nerues, run all alōg euen through the hand, these wher they are marked are sometimes opened instead of the Liuer veine.

3, 1. The middle or common veines made of the braunches of the *Cephalica* or head-veine and *Basilica* or Liuer veine.

4. 1, 2. The diuision of this common veine aboue the wrest, which from 3, to 4. is called the cōmon vein of the cubite or lower arme: but at 4. it is diuided, one part going to the outward side, another to the inside, and so mingleth it selfe with the neighbour veines, this veine is not opened.

5. 2. The outward braunche of this partition which wareth the back of the hand.

66. 2. A braunch of the common veine which vnder the thumbe is opened for the *Cephalica* or head veine.

7, 2. The veine called *saluatella* a braunch of the *Cephalica* and *Hepatica*, which aboue the little finger is opned for the spleen and diseases thereof.

8. 2. A veine between the middle and the ring fingers, which some take to bee that which *Auicen* calleth *Sele*.

9. 2. A branch toward the ring finger.

AA. 2. Braunches comming from the veines which about the loynes are produced knotily, these in the loynes are scarified.

B, 1. Braunches proceeding from the *Epigastricke* veine, distributed to the four paire of muscles of the *Abdomen*, a notable branch of which is wounded often, when men are cut for the rupture.

CC. 2. Veines comming from the vtter branch of the trunke of the hollowe veine called *vena cauæ*, and are dispersed thorough the muscles and skin of the buttocks.

DD. 1. Veines distributed through the pectorall muscles and the breast.

E, 1. Veines reaching to the breastes from the veine called *mammaria*.

FF. 1, Small veines comming out from the veines which are couched vnderneath and go to the chest, the principall of these are scarified in the shoulder blades.

**, 1. Certaine small veines reaching to the outside of the belly comming from the veines of the muscles vnderneath.

G. 2. A branch that runs along by the side of the chest.

H. 2 A veine which reacheth to the shoulder, the muscles of the shoulder blade, and the glandules in the arme holes.

II. 1. The inner crurall veine springing out neare the leske, and goeth vnder the skin to the very foote, hauing a nerue running aboue him all the way.

KK. 1, Branches of the foresaid veine which by the inside of the thigh, reach vnto the very leske.

LLLL. 1. Veines passing vnder the skinne on the foreside of the thigh.

MMMM. 1, 2. The *Crurall* veine carried on the inside and outside of the thigh.

NN. 1. N 2. The inner leg veine called *Tibica*, which is diuersly carried vnder the skin, and here it may bee opened when we would let bloud in it.

O 1. The same carried vnto the fore parte of the inward ankle, and then spreadeth it selfe in the vpper part of the foote called *dorsum pedis*.

P. 2, A Braunch from the vtter *Crurall* veine, sending small furcles to the hippes, the muscles of that place and the skin.

Q, 1. A branch noted with 7, and 9, which bestoweth certaine fuerles vpon the muscles of the leg, and the skin of the thigh.

R S 2, A veine from the ioyning of the branches of that other, which passeth to the back muscles and skin of the thigh somewhat vpward.

TT 2. The Ham-veine *venapoplitis*, which runneth most what where it is marked, and so passeth vnto the calfe of the leg marked with V 2. where it deuideth it selfe into many braunches.

XX 1. The inner braunch of the crurall veine going to the muscles and skin of the calfe.

Y 1. The inner veine of the legge running to the inner side of the foot accompanied with a nerue, this they open vnder the knee instead of the *saphena*.

ZZ 1, 2 2. A part of the crural veine going to the backside of the inner ankle: this is called the *saphena*, and is opened vnder the inner ankle in women most what to farther their naturall euacuations.

αα 1. The outwarde braunch of the crurall veine or the vtter leg-veine called *Tibica*, which is diuersly braunched againe along the outside of the leg & the top of the foot.

β. A part of the foresaid braunch climbing along the outward ankle.

γγ 1. Among the veines of the foote, this is that that vnder the name of the *Cephalica* is opened at the great toe, but not without danger, because it hath a nerue ioyned with him.

The connexion of it.

This Membranous part, as all other Membranes, is made of ſeede. In a Man it is vnder the fat, but in Apes, Dogges, Sheepe, and ſuch like, it lyeth immediately vnder the skin. It compaſſeth the whole body, and cloſely cleaueth to the skin by the mediation of manie Veynes, but fewer Nerues and Arteries diuerſly propagated, and through it climbing vp thither, whereto alſo helpe the addition of fleſhy Fibres. It cleaueth alſo to the Membranes of the Muſcles vnder it, but by more ſlender Fibres. It is ſaide by ſome to haue his Originall from the backe, becauſe it cleaueth thereto moſt inſeparably, and there reſembleth the other Membranes; but where it toucheth the arme holes, it becommeth in dogs and Apes very fleſhy, *Galen* ſaith muſculous.

Galen. Admin. & 5. eiuſdem 7.

In Infants it reſembleth Fleſh altogether, becauſe of the aboundance of blood wherein it is ſteeped; in grown bodies by reaſon of continuall exiccation, it becommeth like a membrane, yet ſo, that in the fore-part of the necke and in the forehead, it cleaueth to it ſo faſt with his fleſhy Fibres, that it can vneath be ſeparated, and to the broad Muſcle, that it is thought to giue him his body. It is in a man except the forehead immooueable; in beaſts it is not onely mooueable it ſelfe, but alſo maketh the skinne mooueable eſpecially in the necke, by ſhaking whereof they driue away the Flies, but a horſe in ſhaking of his skin, will ſometime ſhake an vnskilfull rider out of his ſeate. In the inner part which is next to the membrane of the Muſcles, this fleſhy panicle by reaſon of a ſlimy moiſture wherewith almoſt all Membranes are couered, it is ſlippery, that it may not hinder the motion of the Muſcles, and it hath an exquiſite ſenſe, ſo that if it be goaded by any ſharpe humor, it cauſeth a rigor or ſhiuering. The vſes of this Membrane are: To compaſſe the whole bodie, to couer and defend it: To hinder the fat from being melted by the continuall motion of the Muſcles. It ſupporteth alſo ſaith *Galen*, 3. *Adminiſtrat. Anat.* 2. the veſſels which attaine vnto the skin, becauſe there paſſe betweene it and this Membrane, not onely many Capillarie and threddy Veines, but alſo thoſe which wee vſe to diuide in bloud-letting, together with many Arteries and Sinnewes. Finally, it helpeth to conſolidate or heale vp the skin when it is wounded, or otherwiſe violated; for without fleſh it cannot revnite, ſo ſaith *Ariſtotle* in his third Booke *de Hiſtoria Animalium*, 11. *Whereſoeuer the skin is without Fleſh, there it cannot revnite being diuided.* In brute Beaſts, the thickeneſſe and faſtneſſe of this Membrane, reteyneth the bloody vapors, and turneth them into good blood, and beſides it maketh their skins mooueable. And thus much of the Common Containing or Inveſting parts. But becauſe we made mention euen now of the Veines which run betweene the skin & the fleſhy Membrane which are vſually many of them opened in Phlebotomy; and for that young Chirurgions had neede be betimes acquainted with them, we haue on the former ſide of the leaſe added two Tables and their expoſitions at large, by which hee that liſteth may in one view ſee all the branches of the skin veines how they are ſeated, and beſide learne to call them by their names, that when he is commanded, he may know how to buckle himſelfe to his buſineſſe.

Where it is mooueable in Men.

In Beaſts.

The vſes of it.

Galen.

Ariſtotle.

CHAP. IX. *Of the Inveſting or Containing parts, proper to the lower Belly.*

8. Muſcles of the paunch.

THe proper containing partes whereby the Lower Belly is inveſted, are the Muſcles of the *Abdomen* or Paunch, and the *Peritonæum* or Rim of the belly. The Muſcles are in all Bodies alwaies eight, foure on eyther ſide, matched equally in Figure, Magnitude, Strength, and Action. Of theſe there are foure Oblique, two Right, & two Tranſuerſe, all of them haue theſe appellations from the ſcituation and the texture of their Fibres. In Diſſection the Oblique external paire do firſt offer themſelues, which are the broadeſt of all the reſt. Next follow the Oblique internall; the Anatomiſts do vſually call the former oblique deſcendents, the latter oblique aſcendents, but how properly or improperly wee ſhall ſhew heereafter. Next to theſe follow the two Right Muſcles, in whoſe inward parts do appeare thoſe veines aſcending and deſcending, which conioyne about the Nauill. Vnder all theſe lye the two Tranuerſe Muſcles.

Two other Muſcles lately found out.

There are alſo in ſome Bodies two other ſmal muſcles called *ſuccenturiati* aſsiſters, or *Piramidales*

midales, that is, the ſpiry Muſcles. The Hiſtory of all theſe Muſcles, as alſo the Controuerſies and diuerſe opinions concerning them, we will at large proſecute in our Booke of Muſcles, whither for ſatisfaction we referre the Reader.

Next vnder theſe lyeth the *Peritonæum* or rim of the belly, a thin Membrane like vnto a Spiders web, which enwrappeth all the inward parts in this venter conteined. Towardes the bladder eſpecially it is euidently duplicated, betwixt which duplication thoſe veſſels which the ancients cal *Vaſa vmbilicalia*, the Nauill veſſels, are caried. Of al which it followeth now that we ſhould intreat, beginning with the *Peritonæum*.

Peritonæum or rim of the belly.

The vmbilical veſſels.

CHAP. X. *Of the Peritonæum or rim of the belly.*

THE Muſcles of the *Abdomen* and their Tendons being remooued, we meet with a Membrane ingirting the whole cauity of the lower belly, which they call the *peritonæum*. Immitating heerein *Hippocrates* and *Galen*, who giue it that name, becauſe it compaſſeth all thoſe parts which lye between the Midriffe and the Thighes. Or becauſe it firmeth or ſtrengthneth all the *viſcera* or entrailes that it conteineth. The *Arabians* call it *Ziphachi*, as they call all other Membranes and particularly *Charmel*, others call it the Membrane or coate of the *Abdomen*, we call it the Rim of the Belly. The figure of this Membrane is ouall, or like an Egge, [*Tab.* 5. AABCD.] The greateſt it is of all the Membranes of the belly, as incompaſsing the greateſt cauity of the whole body. In Longitude and Latitude, it anſwereth the whole inferiour venter. It is made of Spermaticke threds and the Mothers blood powred between them, after the maner of a *Parenchyma*. It proceedeth from the Meninges or Membranes of the braine which inueſt the marrow of the backe and the Nerues, but hath his beginning betwixt the firſt and the third Spondell or racke-bone of the Loines; and that is the reaſon why there it is ſo thicke that it cannot be ſeparated without tearing in pieces.

The rim of the bellie or *Peritonæum*.

7. *Epidem.* 6 *admin. An.* 4.

The names.

The Figure.

The quantitie or dimenſions of it.

It is knit aboue, which part *Galen* 4. *de vſu partium* 10, calleth *vertex peritonæi*, to the *Diaphragma* or Midriffe, ſo ſtrongly, that when it is enflamed, the *Hypechondria* are drawne vpward; below, to the Bones of the Haunch and Share; before, it obſtinately cleaueth to the white Line, and to the Tendons of the tranſuerſe Muſcles, (of it ſelfe alone it conſiſteth without connexion, below the Region of the Nauill at the ſhare bones; for as it applyeth to the region of the Nauill, it is knit to the thin Tendon of the tranſuerſe muſcles: backeward, to the originals of the tranſuerſe muſcles, and to that membrane of the Nerues proceeding from the Spondles of the loynes (from whence ſome ſay it ariſeth) & to all the *viſcera* or entrals, to whom it affoordeth ſeuerall membranes.

The connexion.

His ſubſtance is membranous and thin, *Galen* 4. *vſu part.* 9. addeth ſimple, (yet ſtrong and compact) that when the belly is full of meate, or the wombe of the burthen, it might be without danger ſtretched and relaxed as wide and long as neede required. Thinne it is before, leaſt it ſhould be a burthen to the parts vnder it; yet ſo, that in men it is thicker from the Sword-like Cartilage or breſt-blade as farre as the Nauill, then it is neerer to the Share; but in women it is ſtronger from the Share to the Nauill, that it might better endure diſtention as the burthen groweth. Toward the backe-bone about the Loynes it is thicker, becauſe it is to be ſliued or parted into many Cobweb-like membranes, which it affordeth to the Entrals, yet are theſe very ſtrong that they might be able to containe or keepe downe windie diſtenſions; and leaſt in holding of breath, or when they are ſtreatched they ſhould be broken. On the inſide it is ſmooth, and as it were lined with moiſture, that it may not offend the ſmoothneſſe of the entrals, and ſometime hath greaſe adioyned to it (which moſt what accompanieth the veines) eſpecially about the ſtomack and holy-bone. On the outſide it is ſharpe or harſh and fibrous (ſaith *Fallopius*) that it may the better cleaue to the muſcles. It is euery where double, which yet is moſt conſpicuous about the *Ridge*; the lower part or membrane of this duplication, is couched vnder the hollow Veine, the great Arterie, and the Kidneyes; all which the vpper and more inward part couereth, that the Veſſels being on euery ſide guarded and defended, might ſecurely diſperſe their branches betweene thoſe two membranes.

The ſubſtãce of it.

Where thicker and where thinner.

The duplication of this *Peritonæum*.

So the *Peritonæum* is doubled, where the Nauell veſſels paſſe through it on this maner. The two Arteries [Tab. 6. aa.] ariſe from below to the [Tab. 6. C.] nauell; and the veine aſcendeth alſo from the nauell [Tab. 6. from D to the vpper B.] to the Liuer. It is alſo manifeſtly duplicated in the *Hypogaſtrium* or water-courſe, and maketh there a large cauitie, that

How & where it is perforated.

betwixt his membranes the Bladder might bee incloſed. To which membrane it is alſo firmely connected, [Tab. 2. lib. 3. at *]

It is perforated as the veſſels are neceſſarily to paſſe through it, but ſo as the orifices or verges of the membrane are cloſed about the veſſels. Aboue, where it cleaueth to the midriffe, it hath three perforations, one on the right hand for the paſſage of the hollowe Veine, another on the left, that through it the Gullet might be ioyned to the ſtomack, together with the ſinnewes that cleaue vnto it. A third, for the conueying through the great Arterie, the vnmated veine, and the ſinew of the ſixt paire. Belowe, it is perforated about the fiedge, the neckes of the Bladder and the wombe, as alſo where the veines, arteries and ſinnewes which are ſent into the thighes, are diſtributed thorough the *peritonæum*

A.A. B.C.D. The vpper, lower, and laterall partes of the *Peritonæum*.

E E. The White Line from the Griſtle of the breaſt bone, called the Breaſt blade, to the Cõmiſſure or meeting of the ſhare bones.

F. The Griſtle of the breſt-bone, *Cartilago enſi formis*, or the breaſt blade.

G. The Nauill which, al the Muſcles being taken away, muſt bee kept for the demonſtration of the vmbilicall veſſels.

H H. The productions of the *Peritonæum*, which containe the ſeminary veſſels on either ſide.

* The hole which giueth way to the ſeminary veſſels of men.

I I. A Veine and an Arterie from the Epigaſtricke, which beeing carried vpward vnder the right Muſcles, do heere hang downe, and are diſtributed into the lower part of the *Abdomen*.

K K. A Veine and an Artery from the internal Mammary proceeding from vnder the bone of the breaſt, are carried downeward thorough the right Muſcles, and are diſſeminated into the vpper part of the *Abdomen*.

1, 2. The place wherein the right Muſcles ariſe, which being here cut off, do hang down, that their veſſelles may the better bee ſeene.

3, 4. The *Anaſtomoſis* or inocculation of the foreſaid veſſels, making the conſent of the *Abdomẽ* and the noſe, and of the wombe with the breaſts, as ſome thinke.

L L. Branches of Veines running into the ſides of the *Peritoneum*.

N. The place of the hanch bone bared, to which the oblique & the tranſuerſe Muſcles do grow.

The ſecond Figure.

a The deſcending veſſels proceeding frõ the trunk of the hollow veine, and the great Arterie vnder the breſtbone. *b* The veſſels aſcending frõ the *Epigaſtrick* veſſels *ccc*. *Anaſtomoſes* or the inocculations of the aſcending veſſels with the deſcending.

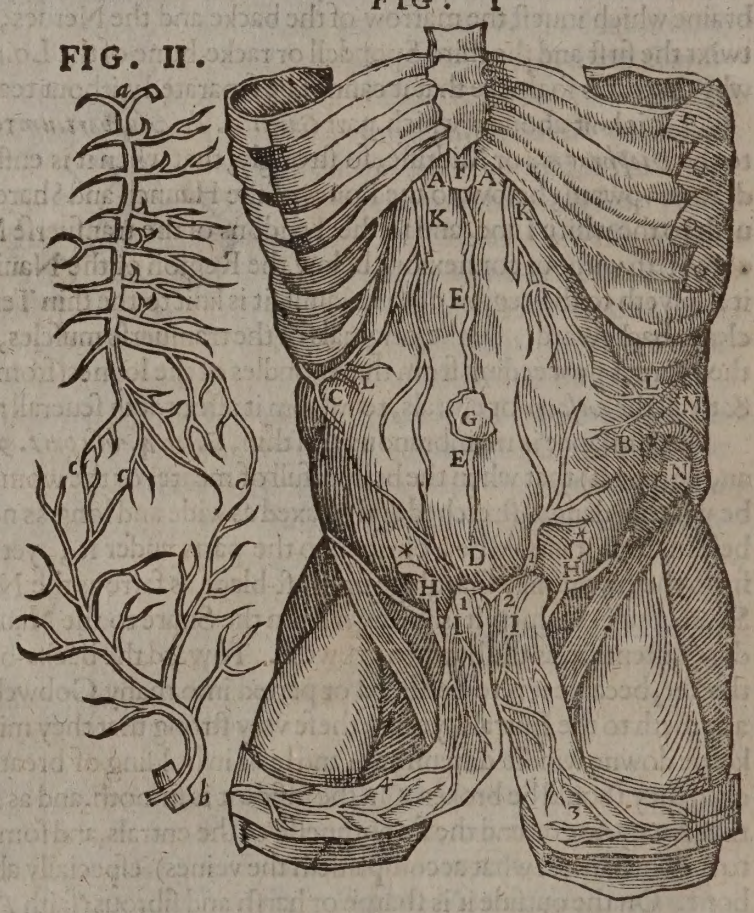
¶ *The firſt Figure ſheweth the right Muſcles of the Lower Belly, with the veſſels, and the lower belly it ſelfe couered with the* Peritonæum *or Rim, all the Muſcles being taken away.*

The ſecond Figure ſhewes the Veines and Arteries which deſcend from the Mammarie veſſels, and thoſe which aſcend from the Epigaſtricke.

TABVLA. V.

FIG. I

FIG. II.



it ſelfe, the muſcles of the *Abdomen* and the skin. There are alſo two productions, [Tab. 5. **] on either ſide one, which paſsing from his external membrane ſeated vnder the kidneyes neere the Share-bone, like looſe Canels or pipes, attaine through the Tendons of the oblique and tranuerſe muſcles without the cauity of the belly into the cod, and ſo to the Teſticles, where ſpreading themſelues, they compoſe or frame their proper coat. Through which

which productions the preparing ſpermaticke veſſelles doe deſcend, and the *deferentia* or leading veſſelles doe returne to the necke of the bladder together with the muſcles of the Teſticles in men. But in woemen two proceſſes or productions paſſe from the wombe to the vpper part of the neck of the ſame. To theſe productions adhereth very cloſely the internall membrane, which yet is diſioyned neere the ſhare-bone; which inward membrane if it be broken, and the externall dilated, according as the gut or the Kall ſhall fall downe either in men or women; ſo it cauſeth the one kinde of rupture or the other. This production (the skin being cut in the flanke) if it bee intercepted and taken it vp with a tie cloſe to the *Abdomen*, hindreth indeed the fall of the gut or Kall, but becauſe the ſpermatical veſſels alſo in men are neceſſarily tied with the production, the Teſticle of that ſide muſt needs be vitiated and looſe his vſe; but if the tie be not [at ** in the 5. Table] very neere to the *Abdomen*, then ſome part of the gut falling down, brings great moleſtation, & although there be no outward tumifying or bearing downe to be ſeene nor ſcarcely any can be felt; yet it requireth a new inciſion and a new tie, as we haue learned at the price of other mens experience. Finally, in the forepart about the middle of the belly where the nauill is, it is perforated in the Infant for the paſſage of the nauill veſſelles, that it may receiue nouriſhment from the mother, but afterward that perforation groweth vp, and if it breake out againe, it cauſeth the Nauill-rupture called ομφαλοκήλη.

The reaſon of a rupture. Why a teſticle is neceſſarily loſt in cutting for a rupture.

The coates which the *Peritonæum* giueth to al the viſcera or entrals.

From this *Peritonæum* alſo as from their originall doe proceede particular coates, wherwith euery inſtruement vnder the midriffe is couered, but ſome of the entralles haue thinner coates, ſome thicker, according to euery ones neceſsity: as the kidneyes coate is craſſe and thicke, but thoſe of the ſtomacke, guts, bladder, and matrix much thicker: this coate compaſſeth the proper coates of the entrals and is called the common-coat; the vpper entralles as the Liuer, the Stomacke, &c. borrow it from that part of the Rim which groweth to the midriffe: the nether, as the bladder and the guttes, from that part which cleaueth to the ſhare-bone, as ſayth *Galen* in his 4. booke *de vſu partium*, and chapter 20. There bee alſo two membranes which proceed from this which are double, the Kall and the Meſentery, and ſome ligaments, as the ligament of the Liuer. Veines and Arteries the Rim hath from the neighbor veſſels aboue; from the veſſels of the midriffe which are called *Phrenica*; behind, from the muſcles which goe away by the loynes and ſo run through the ſides [Tab. 5.[11]] of this *Peritonæum*. Before and ſomewhat higher [Table 5.[**]] from the Mammarie or Pap veſſels which trēd downward vnder the ſword-like cartilage or breſt-blade to the right muſcles; lower frō the *Epigaſtricall* veſſels [Table 5.[11]] aſcending vnder thoſe right muſcles it receiueth certain ſurcles or branches for his nouriſhment and preſeruation of his natural heat; ſometime alſo ſeueral tendrils are communicated vnto it from the ſpermatical veines.

His Nerues are very threddy which it hath from them that are diſtributed into the muſcles of the *Abdomen* by which it receiueth ſence.

The Vſes of this *Peritonæum* or Rim, are; Firſt ſayeth *Galen* in the 4. booke *de vſu partium* and the 1. chapter, to couer the parts contained in the lower belly; but this vſe ſayth he, is not the principall, becauſe thoſe partes are well couered beſide with the muſcles of the paunch, a great deale of fat and the skinne. The ſecond vſe is, that it ſhould bee a *medium* or meane betweene the entrals and the muſcles, and ſo hinder the Kall and the ſmall guts from falling into the ſpaces betwixt the muſcles or vnto the skin; (as it hapneth when this membrane is broken) where they would cauſe great paine, hinder the motions of the muſcles, and the free depoſition or auoydance of the excrements; all which inconueniences we finde when this Rim is wounded and not perfectly and rightly cured. Thirdly, it helpeth much to the ſpeedy vnburdening of the belly; for, becauſe the muſcles of the paunch and the midriffe by reaſon of their different ſcituation, cannot in their contraction ſtreyne the whole belly equally and alike in euery place: the continuated poſition of the Rim ſupplieth that want, as when a man caſteth both his hands vpon a bag of hearbes and compaſſeth them about on euery ſide, hee may more equally ſtraine the liquor out of all the parts of the bag. Fourthly ſayth *Galen* in the booke next aboue named and the 17. chapter, it giueth coats to all the entrals of the lower belly, and produceth diuers ligaments, as we haue partly touched before, and ſhall do more at large hereafter. Fifthly, it firmeth and ſtrengtheneth all thoſe entrals, eſpecially the ſtomacke and the guts, which otherwiſe being diſtended with wind would be violated yea torn as it were, and their coats ſliuen aſunder; beſide, it tyeth them together and holdeth thē fixe in their proper places. Finally, it is a ſauegard to the veſſels, which hauing a long courſe to run, and being but ſlender of themſelues, are ſecured betwixt the duplicated membranes of this *Peritonæum*.

The vſes of the Rim.

Galen.

Of

CHAP. XI. *Of the vmbilicall or Nauel vessels.*

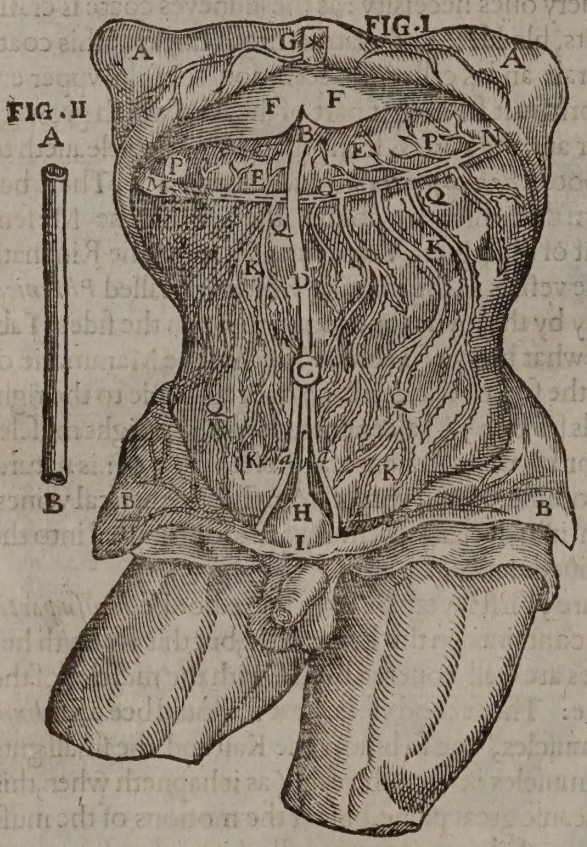
The names of the Nauell.

THey are called *vasa vmbilicalia*, because they passe through the Nauel which is called *vmbilicus*, for of their convolutions or fouldings one with another, is the Nauell made; the Greekes call it ὀμφαλος, ἀπὸ τοῦ ἐμπνεῖν, which signifieth to breath, by reason of the Arteries in it by which the infant in the Wombe breatheth or receiueth breath. *Aristotle* in the first Booke *Hist. Animal.* and the 13. Chapter, calleth it ῥίζα γαστρὸς, the roote of the belly, because by these vessells, as by the strings of the roote, the Infant draweth nourishment from the cake or Liuer of the wombe, as it were out of the earth. The Latine name *vmbilicus*, is deriued *ab vmbone*, which signifieth the bosse of a Buckler, which is represented in the middle of the belly, yea in the very middle and center, saith *Galen* 15, *vsu part.* 4. of the whole body, if you stretch out your armes and legs, and draw a circle about them.

What it is.

The sixt Table, sheweth the lower belly, all the containing parts, aswell proper as common, being remooued, & the bowels lying in their natural position, couered with the kall or omentum, together with the vmbilicall vessels.

TABVLA. VI.



A. A. B. B. The inner face of the *Peritonæum* cut into four parts, and so turned backward.

B. The vpper B. sheweth the implantation of the vmbilical veine into the Liuer.

C. The Nauell separated from the *Peritonæum*.

From D. to the vpper B. The vmbilicall veine.

EE. The vtter part of the stomacke blowne vp, neither couered by the Liuer, nor by the Kall.

FF. A part of the *gibbous* side of the liuer

G. Vessels disseminated thorough the *peritonæum*.

* The brest blade.

H. The bottome of the bladder of vrine

I. The connexion of the *Peritoneum* to the bottome of the bladder.

KKKK. The Kall couering the Guts.

MN. Vessels and sinnewes embracing the bottome of the stomacke.

O. The meeting of the vessells of both sides, so that M. N. and O. shewe the seame which *Aristotle* makesmention of in the 4. booke of the parts of the creatures, and the 3. history.

PP. Certain branches of vessels running along the bottom of the stomacke.

QQQQ. Certaine branches of vessels distributed to the vpper Membrane of the *Omentum*, and compassed with fat.

aa. The two vmbilicall Arteries, going downe by the sides of the bladder to a branch of the great artery.

b. The Ligament of the bladder which is shewed for the *Vrachus*. *The second Figure sheweth the vmbilicall Veine.* A. That part which ioyneth to the nauell. *B*. The other that is inserted into the Liuer.

The vmbilicall vessels.

The nauell therefore is the stumpe of the vmbilicall vessells, by which the Infant was nourished in the wombe, [Tab. 6. C.] therefore implanted into the middest of the lower belly, because it was requisite, that as well the Alimentary as the Vitall blood should first apply to the parts contained in this belly. Now the vmbilical vessels are these: One veine, in bruite Beasts there are two: Two Arteries sometimes, (yet that rarely) but one: diuided at the inside of the nauell into two, and in Beasts the *Vrachus*.

The vmbilicall Veine.

The vmbilicall veine [Tab. 6. from D to B] is the first of all the veines, yea the *Principle of Perfection* of all the parts of the body, in respect of their fleshy substance, because it is the vehicle or conueigher of blood, as well for the matter whereof all the *Parenchymata* of

all

all the parts ; wherefore it is alſo the roote of the Gate-veine, and is formed together with the vmbilicall arteries immediately of the ſeede before any of the entrals. And this truth accordeth with the opinions of *Hippocrates* and *Galen*, and with right reaſon : for the Infant needeth both bloud and ſpirits for the generation of his parts : now becauſe theſe muſt be conuayed by veſſels, it followeth neceſſarily that thoſe veſſels ſhould be generated before the parts themſelues ; and theſe are they. So we ſee the ſeede of Corne or ſuch like, when it is caſt into the earth, firſt of all, it ſhooteth out of it ſelfe the beginning of the ſtalke and of the roote together, that afterward the ſtalke may be nouriſhed by the rootes. Semblably in the figuration of Man-kinde at the ſame inſtant that the ſubſtance of the body beginneth to be mou'ded, the vmbilicall veſſel is produced whereby the creature might be nouriſhed and augmented.

Hippocrates. Galen.

Compariſon.

This veine [Table 6. from ^{D} to ^{E}] paſſeth through the double membranes of the Rimme, and in the Infant hauing gotten through the place of the nauill, becommeth ſometimes two, ſometimes preſently after his egreſſe is deuided, ſo that it ſeemeth to bee double, and together with the arteries is compaſſed with a membrane called the *Gut-let*, and ſo runneth out into a great length ; *Veſalius* ſayth of a foote and a halfe long, but oftentimes it is much longer, yea ſometimes double and treble. The veine is full of knottes, by which ſome ſuperſticious Midwiues gather how many children the Mother ſhall haue, but their true vſe is to ſtay and entertaine the bloud, that it might receiue a more exquiſite elaboration for the nouriſhment of the tender Infant. The arteries becauſe they are ordayned to conuay the ſpirites for the ſupport of life are ſtraight and euen without any boſſed knottes at all.

The paſſage of the vmbilicall veine.

The knots of the veine.

When theſe veſſels come vnto the *ſecundine* or after-birth they diſperſe through it notable braunches, and leſſer toward his outward part, which atteining vnto the *Liuer or Cake of the wombe*, doe forme a Net-like complication, till at length they looſe themſelues into ſmall hairie ſtrings, by which as by the tendrils of the rootes of plants, the mothers bloude both alimentary and vitall together with the ſpirit is drawne out of the mothers veines and arteries into theſe vmbilicall veſſelles. From whence the veines conuey the bloud into the Gate-vein, & from thence by the *Anaſtomoſes* or *inocculations* which are betwixt the roots of the Gate and the hollow-veines, it paſſeth into the trunk of the hollow vein, and ſo nouriſheth the whole body of the Infant. The Vmbilical arteries by which the Infant hath tranſpiration do tranſport the vital bloud vnto the *Aorta* or great arterie, & from thence it paſſeth vnto the heart to maintain the natiue heate and life of the little creature. But after the Infant is borne, the Midwife after ſhe haue ſtroaked down the bloud to nouriſh the Babe, caſteth it into a knot cloſe to the belly, and then cutteth it off, and the ſtumpe that is left is the nauill.

The manner how they nouriſh & ſuſtain the Infant.

A direction for Midwiues

And becauſe the portions of them, which are left within the body ſhould, not be altogether vnprofitable, they are turned into ligaments. The veine becauſe it proceedeth out of the Fiſſure or cleft [Tab 6.^{B} and tab. 4. *lib.* 3.^{E}] which is in the hollow part of the Liuer, and thence attaineth betwixt the two Membranes of the Rim vnto the Nauill, becommeth the Ligament of the Liuer, which ſometimes in dropſie bodies openeth (yea and euen in our diſſections we haue ſometimes followed it with a Probe and found it open into the Liuer) and ſo auoydeth by the nauill the water which is gathered in the Liuer : but the chiefe vſe of it is to tye downe the Liuer to the Nauil that it riſe not vp and ſo ſtop the deſcent of the midriffe in our inſpiration. And this vſe of it the Egyptians know full well, for they vſe to flay at this day their Theeues, and they liue in great torment til the Hang-man or Butcher cut the nauill, and then they dye inſtantly, the Liuer gathering vp vnto the midriffe and ſo ſtopping their breath.

The vſe of theſe veſſels after the birth

The way of the dropſie water.

A cruel cuſtome of the Egyptians.

The Vmbillicall arteries [Table 6. ^{AA} tab. 2. *lib.* 3.^{kl}] ariſe as moſt do agree (though *Veſalius* be of another mind) from the *Iliacall* arteries, or rather they are there implanted ſayth *Bauhine*, and running along by the ſides of the bladder [Table 2.^{kl} tab. 4. *lib.* 3.^{aa}] they paſſe vpward through the Membranes of the *Peritonæum* vnto the Nauill, and ſo become the laterall Ligaments of the bladder.

The paſſage of the vmbilicall arteries.

Finally, the *Vrachus* [Table 6.^{b} tab. 2. *lib.* 3.^{i}] or the *vrinarie* veſſel in beaſts, ariſeth from the bottom of the bladder [Table 6.^{B} tab. 2. *lib.* 3.^{g}] and aſcendeth betwixt the two arteries through the duplication of the *Peritonæum*, and iſſuing out at the nauill-ſtead is lengthned into two guts as it were, and maketh that coate of the creature which is called *Alantois*, into which the vrine of the Calfe is poured, which is there retained till it be calued.

The *vrachus* in beaſtes.

But

In Men. But in Man there ariseth from the bottome of the bladder [Tab. 6.[h] Tab. 2. li. 3,[g]] a Ligament like to the *Vrachus* [Tab. 6,[b] Tab. 2. li. 3, 1,[i]] but it is not al perforated. It passeth betwixt the vmbilicall [Tab. 6.[a a].] Arteries, and is firmely knit vnto the nauell [Tab. 6.[c].] to which it fastneth the bladder, and so holdeth it suspended, that it may not mooue this way or that way, or be otherwise in danger of breaking, because (saith *Varolius*) whatsoeuer is separated from the blood whilst the Infant is in the Mothers wombe, is gathereth together in the bladder. Hence it is that new borne Babes haue their bladders distended & full of Vrine, which they auoide in great quantity before they take any sustenance. But afterward as the childe groweth, this Ligament degenerateth into a very smal filament or twist with which the bladder is tied to the *Peritonæum*, and so sustained, that when the bladder is distended, his necke might not be pressed. But of these vessels wee shall haue occasion to intreate heereafter more in our discourse concerning the *Conformation of the Infant*. In the meane time this shall be sufficient. And thus much of the common Inuesting parts of the whole body, & of those that are particular to the Lower Belly: now it remaineth that we decide such controuersies as are on foote concerning them, and so passe on to the nutritiue parts.

The vse of it after the birth

A Dilucidation or Exposition of the Controuersies concerning the Common Inuesting parts of the Body, and those that properly belong to the Lower Belly.

QVEST. I. *How the Haires are nouriſhed.*

THe controuersies concerning the haires, how they are nouriſhed or otherwise encreased, although it bee a matter of no great necessity, yet is it very difficult and full of Philosophical subtility. That they doe encrease from short to long, is not doubted: so also it is past question that nutrition goeth before accretion. *Galen* in his first Booke *De Naturalibus facultatibus*, and in the second *De Temperamentis* saith, that their generation is like the generation of plants; and yet in his Book *de Arte Medicinali*; in the ninth chapter, where hee treateth of the differences of the members, he saith, they haue onely a generation, no gouernment; that is to say, they are generated of recrements, but not nouriſhed or gouerned by any Naturall faculty. And in his second Booke *de Temperamentis* he thus expresseth their production. *But if the vapour be sooty, thicke, and earthy, it remaineth impacted in the straight breathing pores of the skin, neyther easily returning backeward, nor easilie euacuated; wherefore another vapour succeeding from within, striketh the former and thrusteth it outward, and so one vapour following another, they are in time complicated and conioyned, & make a roping body like the soote in a Chimney, but are not nouriſhed at all by the assistance of any Facultie.*

Hence it appeareth, that they are onely excrements, and their auction is but an improper accretion, vtterly deuoide of life, and therefore they are not to be reckoned among the parts of the body; or if they be, it is not because they do participate of life, but because they haue other vses of couering, ornament, and such like, as before in their history is expressed. But there are some of *Aristotles* followers, who contend that they haue a life, but that of nouriſhment onely, not of sense. Which distinction seemeth to mee to bee very friuolous. For if you take from them any part of life, you must also take away all life. Beside

ſide the very ſubſtance of the haire ſo dry and without ſence, is a manifeſt euidence that they cannot be truly nouriſhed. For if they aſſume an Aliment into themſelues, and alter it for their behoofe, what ſhould hinder that they ſhould not encreaſe according to al the dimenſions, length, bredth, and thickneſſe? but we ſee manifeſtly, that they only encreaſe in length, & not otherwiſe, receyuing their additament or aliment, whether you wil cal it, onely at their rootes, not as other parts equally on euery ſide. It will be obiected, that the nailes and the teeth do alſo receiue their aliment after the ſame manner, and yet they are liuing parts. We anſwere, there is great difference. For the Nailes and the Teeth haue all kinds of Veſſels, Veines, Arteries, and Nerues, inſerted into their roots, by which they receyue nouriſhment and ſence, ſo haue not the Haires; and the reaſon why they are onely nouriſhed at their roots, is becauſe Nature foreſawe, that by continuall attrition and colliſion they would ſoone be worne away, vnleſſe new matter were ſupplied vnto them at their roots; and truly we willingly confeſſe, that the extreme parts of the nailes & teeth which are fartheſt from their roots do not liue, neyther are nouriſhed properly, but onely are driuen forward by appoſition and impulſion like as the Haires are. But it ſhould ſeeme that the nature of the Haires and of the nailes is all one, becauſe they both increaſe in dead carkaſſes. Wherefore if the nayles be nouriſhed, why ſhould it be denied that the haires alſo do grow by nouriſhment?

Obiection.

Anſwere.

Obiection. That Haires and Nayles are both of one Nature.

Anſwere.

Heereto we anſwer, that true it is, aſwell the nailes as the haires do ſhoot out after death; but the maner is not alike, for the haires do, ſo and from the ſame cauſes grow in length after death, as they did before; the heat of corruption and putrifaction ſeruing as well, ſo long as the matter laſteth, to driue out the excrement after death, as the naturall heate did while the man was on liue; but the nailes do not grow as they did in the life time, but onely become more prominent, the adiacent parts ſinking from them, as being conſumed by putrifaction. But it may further bee vrged, That the nature of a putrified excrement when it is not ouer-ruled by the faculty, is not to breath outward to the Circumference, but to gather inward vnto the place where the moſt putrified matter is; and this is daily obſerued euen in liuing bodies, that till the offending humour be brought into ſubiection vnto nature, and receiue a kinde of mitigation, it gathereth ſtill to the center; afterwarde, nature hauing gotten the victory, ſhe driueth it as farre from her as is poſsible, euen to the skin; as we ſee it falleth out in Criticall ſweats, in the Meazels, ſmall Pocks, and ſuch like. Now if the putred excrement haue no diſpoſition to the Circũference in liuing bodies when the ſecret paſſages of the body are open, the skin porous, & the faculties euery where at work; how ſhal it paſſe that way after thoſe paſſages and pores are falne, the habit forſaken of the ſpirit, & the trãſpirable wayes locked vp vnder the ſeale of death? It ſeemeth therfore more reaſonable to thinke that the matter of the haires which is added after death, was a ſurpluſage of the laſt concoction celebrated in the habit of the body, and remaining in the extremities of the veſſels which determine in the skin, which being in that place intercepted by the extinction of naturall heate, and hauing no ſpirits to guide it backward; yet hauing before attained the perfection which the faculty could impart vnto it, worketh it ſelfe a way through the skin. But this knot will eaſily bee vntied, if we conſider that after death the haires do not grow or encreaſe in any place of the body, but onely in ſuch, as wherein there were haires ſtanding in the time of life, to the roots whereof, as I ſaide before, the heat proceeding from putrifaction, is ſufficient to driue, though not any humor, yet a vapor which may paſſe where the way was before thrilled and bored, but cannot where the skinne was not notably perforated. Againe, there is a double limit, beyond which the excreſcence of the Haire dooth not proceede. For if either the confluence of the vapour to thoſe pores make a dampe, as in proceſſe of time it will, or the putrifaction of the vapour grow to a Venom, then the Haires ceaſe to encreaſe, but fall not ſo ſoon in dead carkaſſes as in liuing men, becauſe the aire exiccateth and drieth the skin wherein the roots are faſtned; but in thoſe that are aliue whoſe skin is open, they fall not vpon a dampe, for there can be no ſuch thing in a liuing body, but vpon a confluence of a venemous vapor, as we ſee in the *French* diſeaſe and the Leproſie. And ſo much of the Haires.

Obiection.

Anſwere.

QVEST.

Whether the Skin be the Organ or instrument of touching. QVEST. II.

The *Peripatecians* arguments.

THE Philosophers and Physitians striue about the instrument of touching. *Aristotle* and *Alexander* call flesh sometimes the *medium* or meane through which wee feele, sometimes the Organ or instrument of feeling it selfe, but neuer the Skinne. First, because the Skin is of it selfe insensible, and sensible only by reason of the flesh. For the skinne of the head which is without flesh say they, is insensible. Secondly, because flesh bared or exposed to the ayre, is more paynfull then the skin. Thirdly, because there is a more exquisite and discerning sence in the flesh then in the skin. For that Iewellers and Lapidaries doe more accurately discern the differences of roughnesse and smoothnes, and such touchable qualities by the toung then by the hand; and are able to distinguish betweene natural and fictitious precious Stones only by the touch of the tongue. Lastly, because it is a rule in Philosophy, that the sensible subiect beeing placed immediately vppon the instrument of sense is not sensible, but such sensible subiects placed immediatly vpon the skinne are felt, therefore the skin is not the instrument of touching.

An axiome.

Auicen. Fen. 1. cap. Doctr. 4. cap. 1.

To these may be added the authority of *Auicen*, who writeth, that the skinne feeleth not equall bodies or obiects; if it feeleth not equall obiects, then is it not the proper organ or instrument of touching; because euery instrument of sence which the Greeks cal αἰσθητήριον aprehendeth both extreme & also middle obiects; so the eie seeth both the extreme colours which are blacke and white, and also al middle colours made of their mixture, whether they contain lesse or more of either of the extreames. On the other side, the Physitians affirm the skinne to bee the instrument of touching, which will appeare to be the probable and likely opinion whether we consider the temper, the structure, or the scituation of the skin.

The Physitians opinion. Their arguments taken from the temper of the skin.

For the temper, the skinne is the most temperate of all the partes in the very midst of the extreames, and is as it were the canon or rule of them all; and therefore can giue a more perfect iudgement of the tactible qualities.

2. de Animal. Why Iaundy eyes think all things yellow.

Aristotle hath determined that euery αἰσθητήριον or instrument of sence should be ἄποιον; that is, deuoyde of all qualities whereby that sence is affected. So the Christaline humour which receiueth the Images and spectres of visible thinges, is deuoyde of all colours; the yellow eyes of those that are full of the Iaundise imagine all things to be yellow. If the tongue be moystned with choller, all things though sweet haue a bitter tange: in the nose there is no particular and peculiar sent; no sound naturally residing in the eare: right so the skin which hath no excesse of qualities is to bee esteemed the organ or instrument of touching.

The structure of the skin

The scituation of the skin

If we consider the structure of the skinne, there are moe nerues disseminated into it then into the flesh, but the nerues are the common conuayers of all sensible spirits, which they continually minister vnto the sences, whereby their operations are perpetuated. And for the scituation of the skinne, it is much more commodious then that of the flesh, because it is nearer to the occursation or confluence of outward obiects; because it is the limit and border as it were of all the parts. The skin therefore is rather the instrument or organ of touching then the flesh.

Answers to the *Peripatecians* arguments

The first.

As for the forenamed obiections of the *Peripatecians* they are easily answered: for first we deny that the skin feeleth by helpe of the flesh. I instance thus: cut a nerue which endeth into the flesh, presently the motion will cease, but the sence of the skin will remaine; but if a nerue be cut which passeth vnto the skin, presently the sence it selfe will be abolished.

The second.

Againe, true it is that flesh when it is bared is more sensible and painfull then the skinne; but the reason of that is because it is looser, and lesse accustomed to outward iniuries of the ayre or ought else; whereas the skinne is so accustomed to the ayre, that it feeleth it not.

The third.

So the teeth being vsually opposed to the ayre are not affected therewith, but other bones if they be bared doe presently putrifie.

The fourth.

To proceed, the tong hath a more exquisite apprehension of the coldnesse and inequality of precious stones; but that apprhension is not from his flesh but from his membrane; nowe membranes are also instruments of sence. And whereas it is sayd that the sensible subiect or obiect being placed immediately vpon the instrument of sence, is not sensible; that I say is vtterly false, for by that reason there should be no organ of touching saue only a bone, a gristle, or a *vinculũ* or tye.

That

That Axiome of *Aristotle* stands neede to be interpreted: Of the sences some are absolutely and simply necessary to our life, as touching and tasting; some are *ad bene esse*, that is, for the better being of the creature, but not simply necessary to his being, as sight, hearing, and smelling. The *Medium* or *Meane* of these last is externall and separated from the instrument; the *medium* of the first is internall, and so ioyned with the instrument that it cannot be separated. In the first this axiome is true; for if any colour be laid vppon our eye, wee see indeed, but very deprauedly, being not able without an outward meane to distinguish, so likewise it is in hearing and smelling: but in tasting and touching because the *medium* is internall, the obiect may be, yea is best distinguished when it toucheth the instrument. We therefore conclude that the skin is the organ or instrument of touching, and the Cuticle or skarse-skin is his *medium* or meane.

An interpretation of an axiome.

The conclusion.

Whereas *Auicen* sayth that the skinne doeth not feele equall or temperate things, he meaneth that it is not violated or ill affected by them when it feeleth them, not that it feeleth them not at all: for that common experience would condemne. Lastly, you will say that the skinne feeleth by the helpe of nerues; the nerues therefore are the instruments of feeling not the skin. I answere, the flesh of the muscles are moued by the nerues, yet is not the nerue the immediate organ of voluntary motion but the muscle. In like manner the nerue giueth sense vnto the skin, because it bringeth downe vnto it the Animall faculty and spirit, yet nathe-more is it the immediate instrument of sense. But *Galen* sayeth that the stomacke is the organ of touching, because his sence is most exquisit: surely the mouth of the stomacke is wondrous sensible, because of the notable nerues it receiueth from the sixt coniugation, and by reason of the hunger and thirst of which it onely is apprehensiue: we acknowledge it the instrument or Organ of a peculiar and particular touch, as also the partes of generation haue their peculiar touch whereof they are instruements; but onely the skin is the Organ of externall touching, and sole iudge of all tactile qualities.

Answere to *Auicen*.

Another argument answered.

Answere to *Galens* authority.

Peculiar touches in mens bodies.

Of the Temper of the Skin. QVEST: II.

GAlen is of opinion that the Skinne is absolutelytemperate, because it is of a middle nature between bloudy and vnbloudy, whence it is called a neruous flesh and a fleshy Nerue; so in another place, if the flesh bee adstringed and dryed, it becommeth like the skinne; for the skin is dryer and thighter then the flesh. *Hippocrates* also expresseth so much where he sayth, *The outward Skin which is continual with it selfe and with the bloudy Nerue, because it is exposed to the aire, sometimes colder, sometimes warmer, is often affected by both, and needes now and then the help of the one to temper the other.* On the contrary it may be proued by the authorities of *Galen* and *Auicen* that it is not Temperate. *Galen* sayth that the Skin is nourished with phlegmaticke bloud; it is therefore of the Temper of Phlegme, for the nourishment of any part is the same with that whereof it is compounded. *Auicen* sayeth that the flesh commeth neerer to exact equality of Temper then any other part. The flesh therefore and not the skinne is temperate. Moreouer, that cannot be temperate which is the weakest of all parts: now the skin receiueth the superfluities of all the inward partes, and is therefore called the vniuersall Emunctory. But all these knots may easily be cleft with a soft wedge. The skin is nourished with phlegmatick bloud, that is, not ful boyled and labored, when wee know it is hot not cold. *Auicen* sayth not, that flesh is most temperate, but that it commeth neerest to that which is temperate; so the whole body of Man is sayd to bee temperate, although it be hot and moyst.

That the skin is temperate.

Hippocrates. That it is not.

Galen.

Answere to the arguments which proue it not to be temperate.

The weakenesse of the Skinne proceedeth not from the Temper, for it is not weake of it selfe or of it owne nature, but by euent, by reason of the scituation and the vessels. For the greater vessels, because they are neerer to the fountaine are the stronger, and the expelling vertue of the inner-parts more powerfull: whence it is, that the inward partes expell their superfluities into the outward, and the greater vessels into the smaller vessels of the habit; so that the skinne becommeth weaker, because the expelling faculty is withinwarde and stronger, and layeth all the burthen vpon the skinne: and somuch for satisfaction of the aduersaries.

Why the skin is weake and becomes an Emunctory.

There is another scruple arising out of this Doctrine of the Temper of the Skinne; and that is, whether a Physitian by the Skinne may iudge what is the Temper of the whole body. *Aristotle* gathereth from this instrument of touching, the vigour of the minde it selfe, because

Whether by the skin the temper of the whole body may be known *Aristotle.*

becauſe where the touch is fine, there the ſence is leſſe polluted, & the Phantaſmes ariſing there from more ſubtile; and ſo the operation of the ſoule higher and more abſtruſe. *Galen* reſolueth the doubt where he ſayth; They are in an errour who doe determine alwaies of the Temper of the whole body by the skinne; for though the skinne be hard, yet is not the Creature neceſſarily dry; neither if it be ſoft & without haire is the whole creature moiſt; yet if the whole body be in equall Temper, then it is reaſonable that all the parts ſhould be proportionably correſpondent to the Temper of the Skinne, but if the body be vnequally tẽpered as oftentimes it is, from the nature, by accident, or by diſeaſe, then is it not reaſonable to iudge of the body by the skin. For we ſee that in Oyſters the fleſh is very moiſt, yet is their skin, which is their ſhell, beyond meaſure dry.

Galens reſolution of the queſtion.

Of the Originall and Generation of the Skin. QVETS. III.

THere are many opinions about the generation of the Skinne. The common opinion is, that it ariſeth from the dilated endes of the Veines, Arteries and Sinewes, becauſe it euery where feeleth, liueth, and is nouriſhed: now life is communicated by the Arteries, nouriſhment by the Veines, & Sence by the nerues or ſinewes. For my owne part I doe not deny but that many veſſels are carried vnto and doe determine in the skin. From the Axillary, Iugular, and Crurall veines, many ſmall Surcles, and as many Arteries bearing them company: interlaced alſo it is with manifold Nerues, but yet I am not reſolued that the skinne is wouen together of their threds. *Galen* thought the skin was the firſt part of the Infant that was formed, the trueth of which aſſertion we ſhall diſcuſſe in another place. Some thinke the Skin is made of the ſuperficies of fleſh dryed, becauſe in woundes, the fleſh dryed degenerateth into a Cicatrice or Scarre, which is very like the nature of the skinne; this may bee confirmed by the authorities of *Ariſtotle* and *Galen*. *Ariſtotle* auoucheth that as the fleſh groweth old, ſo it turneth into skinne. *Galen*, that the skinne is produced out of the fleſh which is vnder it. But becauſe between the fleſh & the skin there are many bodies interpoſed, to wit, the Fat and the fleſhy Membrane, which is truely neruous, vnleſſe it be about the neck & the face, I cannot ſee how the skin ſhould grow out of the fleſh. And that skin or ſcar rather which reſulteth vppon wounds, when the fleſh is ſoftned & dryed by *Epulotical* medicines as they call them; is not a true skin but illegitimate, ingendred of a ſubſtace of another kind; for it is harder then the true skin & more thight, & therfore neuer hath any haire growing vpon, it and in tanning it will fal away, whence comes the holes in Sheep skins, when they are made into Parchment. Some thinke it is compounded of fleſh and ſinewes mingled together, becauſe in many places of *Galen*, the skin is called a bloudy nerue; but this is prooued to bee falſe by this one argument, becauſe where there is moſt ſtore of nerues, there the skinne is not the harder for thẽ; as in the palme of the hand there are more nerues then in the crown of the head, and yet the skinne in the crown is much harder then that of the palme. I think, and for this time determine, that the skin is ingendred together with the other parts, to wit, of ſeed and bloud mixed together; and may therefore be called a fleſhy nerue, or a neruous fleſh, becauſe it hath a middle nature between fleſh and a ſinew: for it is not vtterly without bloud as a nerue, nor ſo abounding with bloud as fleſh. That there is bloud in it appeareth euidently if it be neuer ſo little wounded; that it is of ſeed, this one argument may ſerue for all, that when it is periſhed it can neuer bee reſtored, for it is impoſsible to heale a wound where any part of the skinne is taken away without a ſcarre or Cicatrice more or leſſe,

The common opinion.

Other opinions.

The differẽce between a ſcar and the true skin.

Another opinion.

But proued falſe.

The determination.

An argument that the skin is made of ſeede. and bloud.

Whether the Skin performe any common and officiall action. QVEST. IIII.

MAny Phyſitians haue the ſame opinion of the vſe and action of the Skinne which they haue of the vſe and action of Bones. The Bones haue a common or official vſe, ſo ſayth *Hippocrates*, they giue the body ſtability, vprightnes and figure, but that they performe no common or officiall action. I account that a common action which is ſeruiceable either to more parts or to the whole creature. In like manner, the skinne hath indeed a common vſe, becauſe it couereth the whole body, cheriſheth it & tyeth it together, but it is not thought to performe a-

The common opinion.

Hip. lib. de natu. oſsium.

ny

ny officiall or common action. *Galen* speaketh very plainely, *The skin* (saith he) *concocteth not, as the stomacke: it distributeth not as the Guts and the Veynes: it breedeth not bloud as the Liuer, it frameth not any pulsation as the Heart and the Arteries; it causeth not respiration, as the Lungs and the Chest, it mooueth not with voluntary motion, as the Muscles.* Notwithstanding all this, one common action may bee attributed vnto it, to wit, an Animall action. For although all sensation is passion, because to be sensatiue is to suffer, yet there is no sensation without an action. The better learned Philosophers in all sensation doe acknowledge a double motion, one Materiall, another Formall: the former motion is in the reception of the species (for we must craue liberty to vse our Schoole tearmes) the latter in an action; the first is in the Instrument by reason of the matter: the latter, by reason of the power is in the soule; the first is not the effectuating cause of sensation, but a disposition thereto: the latter is essentially sensation it selfe. Whereas therefore the skinne is apprehensiue of those qualities which strike or mooue the tactiue sense, and is thereupon esteemed the iudge and discerner of outward touching, it performeth vnto the whole creature not onely a common vse, but also a common or officiall action. Beside it hath another priuate action, to wit, Nutrition, to which as handmaids do serue the Drawing, Reteining, Concocting and Expelling Faculties, & more then these hath no part in the body of man which serueth for the behoose of the whole. Wee conclude therefore, that the skin beside his common vse and priuate action performeth to the body a common and officiall action, to wit, Sensation.

The common action of the skin is animal

How sensation is made.

The priuate action of the skin.

QVEST. V. *Whether it be heate or colde, whereby Fat is congealed.*

THE diuers yea contrary gusts of opinions amongst ancient Physitians about the generation of fat, hath raised such a tempest in our Art, that the Waues are not to this day setled. There needeth therefore some *Æolus, mulcere hos fluctus* to appease these waues, to call in the windes, or to abate them into a calme, which we will at this time intend to do in want of better helpe as well as we may. And because we would not bee accumbred with the variety of names which are vsually giuen to this substance, you shall vnderstand, that *pinguedo, adeps, auxungia*, and *sevum*, are promiscuously vsed by Physitians, albeit *Aristotle* and *Galen* haue taken great paines to distinguish them euery one from another. To which places, we refer those who desire heerein satisfaction. For we will onely paine our selues about the temper and generation of fat at this time.

The names of Fat. 2 *de partib. Animal.* 4. & 11. *de simpl. med. c. Facultat.*

Galen is of opinion, that fat is congealed by colde, and that he expressely declareth together with the manner of it in this manner. VVhen the aiery and more oyly part of the bloud sweateth through the thin coates of the Veines in maner of a dew, and lighteth vpon the colder parts such as are Membranes, it is then by the power of the cold condensed. And hence it is, that women are for the most part fatter then men, because they are colder; & the same reason is of al other creatures growing fatter in the winter time, as do also those that haue smaller vessels; now we know, that the smalnes or narrownesse of the vessels, is caused by the coldnesse of the temper. And if at any time those creatures which haue large vessels do not yet grow fat, it is not from their naturall, but from an aduentitious temper acquired by accident (to wit) by diet and order of life. Moreouer, that fat is congealed by colde, hence it is euident, because by heate it is presently molten and liquefied. The Lower Belly because it is Membranous and farre remooued from the fountaine of heate, is therefore couered ouer with a leafe of fat, which sometimes is of great weight; but the parts vnder the breast haue lesse fat about them. And this is the Philosophy of *Galen*, and almost all the Greeke and *Arabian* Physitians. Those that hold the contrary, do thus demonstrate the matter of Fat to be hot, the worker of it heat, and the effects of it hot. For the matter, *Galen* himselfacknowledgeth it to be made of the aery fat & oily part of the blood, as also is choler and seede; and therefore those creatures that are fat grow barren, and if wee would fat any thing, we first lib or geld it. And *Aristotle* saith, that that which is fat, is neither earthy nor watry, but airy; and therefore it floateth alwayes aboue. Now ayre we know is hot and moyst. That the efficient or working cause is hot, *Aristotle* first of all men prooued, where he saith, That fat is made by concoction or boyling, but it is onely heat which concocteth or boyleth any thing. And in his Problemes he giueth this reason, why that which

How Fat is curdled. *Galens* opinion by cold.

Why women are fatter then men.

Arguments to proue that it is curdled by heate. 3. *de hist. anim.* 2 *de partibus Animal.*

is fat is not of ill sauour, because (sayth he) it is not crude or raw, but concocted. This opinion of the Philosopher doth the learned *Veiga* follow and *Argenterius*, as also *Laurentius Ioubert*, who set foorth an elegant and subtile Paradoxe concerning the nature of fat. The weight of the principall reasons for this opinion, we will as briefely as wee can set before you. All concretion is made by that which is actually cold, as is seene in Ice, oyle, honie, and such like, which by the outward cold aire are congealed: but there is no such actuall cold in a liuing body; the bones are verie hot if they bee touched, and all the Membranes are actually hot, for the membranous stomacke boyles the *Chylus*, the membranous bladder burneth the Flegme euen into a stone. *Auicen* saith, That the Membranes are hotter then the Braine; now the braine is hotter then the most soultry hot aire that is in the heate of Summer: but the Summer heate melteth and congealeth not; the coldnesse therefore of the Membranes cannot congeale the fat. Againe, the heart which is the hottest of all the inward parts, and in perpetuall motion, is yet compassed about the *basis* with aboundant fat. About the Membranes of the Braine, which are watred as it were with aboundance of blood, and wouen with many thousand vessels, neuer any fat adhereth: nor vnto the coates of the bones. Old men and melancholy persons, whose temper is cold, haue yet little fat. The Kidneyes which are very hot, and bake, yea burne Flegme into stones, haue yet about them abundance of fat. Beside, the fat is a liuing part of the body, because it hath a certaine and definite forme or figure, & is whitened by the power of the membrane which altereth it; now who euer durst say, that a liuing part of mans body was made by actuall cold? We may also add the authority of *Galen* fauouring their opinion, where hee saith, That in cold and dry bodies the fat is larded amidst the flesh, not about the membranous coates; but euery one will confesse that flesh is hot. Finally, the effects do teach vs that fat is hot. For *Galen* reckoneth it among concocting Simples; and the fatty kall (saith he, in his Booke of the vse of Parts) by his heate furthereth the concoction of the stomack; beside, it easily taketh fire. Wherefore they referre the cause of the concretion or congealing with *Aristotle*, to the fastnesse and thightnesse of the Membranes. For say they, the ayery and fat part of the bloode, passeth easily through the rare and spongy flesh: but when it commeth to the Membranes, there it is stayed and congealed by heate, and becommeth white through the operation of the spermatical part to which it adhereth, to wit the Membrane. Add heereto the authority of *Hippocrates*, who saith, *That heate is the seate and residence of Fat.*

That cold cannot congeale the fat.

Melancholy men seldome Fat.

The effects of fat are hot.

Pinguis sedem & metropolim esse calidum.

Thus you see the battell pitcht on either side, and contrary Ensignes and Armes in the field. Both parts cannot be maintained. It is more safe to side with the old Legions led by *Galen*, and followed by the Ancients, then with new and vpstart Nouices; wherefore, we will determine thus; I wish it may be with approbation of the best.

The determination.

What kind of cold curdleth Fat.

Exemplifications.

Lesse heate is taken for cold.

The Matter of Fat is a very and oyly, the Efficient cause a congealing colde, yet not absolute and actuall (for there is no such colde in any liuing creature) but lesse hotte, which Philosopers take for colde, so that the fat is congealed not by parts that are absolutelie cold, but by parts that are lesse hot then others, such as are Membranes. But this may better be exemplified, then taught by precept. Lead as soone as it is taken off the fire, although it be yet fiery hot, caketh together: this concretion is eyther by vertue of heat or cold; not by a fiery heate, for that melted it before; not by actuall cold, for if you touch it thus caked, it will burne; therefore by a remisse heate, which to it is in stead of colde. For there is a certaine degree of heate, which will not suffer Lead to cake, nor Fat to curdle. This degree is onely in the fleshy parts; whence it is that fat neuer growes about them. But Membranous parts, because they haue not the same degree of heate, doe curdle the Oylie part of the blood into fat. When a Vessell of boyling water is couered, though the couer be hot, yet the vapour of the water turneth into a steame vppon it, and will stand in drops, yea will run from it in water, as we see in Stils, though the head be so hotte that a man cannot touch it. What then is the reason? Because in the Couer there is a lesse heate then in the boyling water. For it is heated onely by a vapour, the water immediatelie by the fire; The lesse heate therefore of the Couer or head, is in stead of colde to the boyling water.

Why Melancholy men sweate much.

In like manner, in Melancholy men their hot and boyling entrals raise vapours, which when they come to the skin which is lesse hot then the entrals, are gathered and thickned into sweate. So the breathing vapours of all the lower parts being raised into a hot braine which yet is lesse hot then the lower parts, are turned into water, & fal down in Rheumes,

Gowts, and ſuch like. As for this manner therefore wee ſay that Fatte curdles by colde, that is, by a leſſer heate then will melt it; ſo wee ſay the Brayne is cold, that is, leſſe hot, although it be hotter as we haue ſayd, then the ayre can bee in the heate of ſummer. That ſummer ayre or hot gleames wee call hot, and ſo they are; yet are they colde in reſpect of fire, yea cold in reſpect of the heate of a liuing creature; the heart by them being refrigerated: for our life is proportionable to fire; and it is a true rule in Metaphyſicks (that is in Logicke,) that meanes are contrary to their extreames, elſe ſhould not liberality which is a vertue, be contrary to couetouſnes and prodigality, which are the extreames and vices.

It is a fiery heat that we liue by.

Meanes are contrary to their extreames.

Theſe things being thus firſt determined, we will now anſwere the argument vrged againſt vs. Firſt, we deny that all concretion or coagulation is done by actuall colde; for as it is ſayd, Lead yet firie hot, will congeale; and whereas Fat groweth to the heart, which is the hotteſt of all the parts, we anſwere, that herein is a great document of the wonderfull and prouident wiſedom of Nature, who hath thus prouided leaſt in perpetuall motion the hart ſhould gather ſo great a heat as ſhould waſte & conſume it; for which cauſe alſo ſaith *Hippo.* it lyeth in water much like vrine, that it might euer be freſh, & as it were flouriſhing.

Anſwere to the former arguments.

The wonderfull prouidēce of nature.

Chryſippus that notable *Stoicke* in his booke of *Prouidence*, ſayeth that the finall cauſe ouercommeth both the efficient and matter in naturall thinges; and *Ariſtotle* againſt *Democritus* ſayth, that in the workes of nature the end is the firſt and chiefe cauſe, for it moueth the other cauſes, it ſelfe being immoueable. I know that our aduerſaries will obiect, that nature indeuoureth nothing againſt her owne lawes, ſhee ſhould therefore haue made the heart temperate. But let me retort their owne weapon againſt them, Nature ſhould haue made the heart originally temperate, that there might haue beene no neede of breathing cold ayre; how abſurd this oppoſition againſt the wiſedome of nature is, no man but ſeeth. For the heart was neceſſarily to bee created very hotte, becauſe in it is the hearth and fire whereby the naturall heate of all the parts is preſerued and refreſhed. If they thinke not the Fat of the heart neceſſary, let them remember that it groweth not in the ventricles, nor in the fleſh of the heart, but onely vpon the Membranes of the veſſels, which are parts leſſe hot then any of the other. Some there are which add further that this Fat is a part of the heart, becauſe it keepeth alwayes the ſame figure and circumſcription, and is not melted by fire, but rather torrifieth.

The finall cauſe is the firſt and chiefeſt in works of nature.

For the Membranes of the Braine, we ſay they haue no Fat, becauſe there was no vſe of it; yea it would haue hindered the breathing out of the ſmoaky vapors by his clammineſſe. For the Braine like a cupping glaſſe draweth continually and ſucketh vp the expirations of the inferior parts, to which if the Comb-like ſutures of the Skul did not gape and giue way, the Braine would be made as it were drunke with their aboundant moyſtures. Beſide, Fat would haue hindred the motion of the Brain, for it moueth perpetually as the Pulſe doth, as we ſhall ſhew in due place; wherefore in the Braine there wanteth the finall cauſe of Fat. The materiall cauſe is alſo wanting, becauſe there is required a great aboundance of bloud for the nouriſhment of the brain, and for the generation of Animall ſpirits; it behoued not therefore that it ſhould be conuerted into Fat. Old men and thoſe that are melancholy are ſeldome fat, becauſe the material cauſe of it is wanting, for they are too dry. The Fat of the Kidneyes compaſſeth not the fleſh, but their membranes only. *Ariſtotle* ſaith that both kidneyes are fat, but the right leſſe then the left, becauſe it is the hotter. And whether the Fat be a liuing part, we ſhall diſpute in our next exerciſe. Finally, whereas *Galen* ſayth that in cold and dry bodies the Fatte is Larded through the fleſh, not through the coates or membranes; we anſwere that by fleſh in that place he vnderſtandeth the muſcles which are couered with their proper coates, to which coates the fat groweth, becauſe they abound with bloud and veines; but in thoſe coates that are moſt diſtant, whereof he there ſpeaketh, becauſe of their drynes there wanteth matter of Fat; for you may remember wee taught you before, that Fat is not ingendred but only where there is an ouerplus of bloud which ſweateth through the ſpongy fleſh after it is ſatisfied. Now in cold and dry bodies ſuch as *Galen* there ſpeaketh off, ther is no ſuch aboundance of bloud that there ſhould be any ouerplus. The effects of Fat which they mention conclude nothing; it is true that Fat is a concocting medicine, and that the Fat of the Kall relieueth the heat of the ſtomacke, but not primarily and of it ſelfe, but by euent, becauſe the thicknes and viſciditie or clammines of it hindreth the euaporation of the heate, which by that meanes is doubled; beſides it ſtoppeth vp the pores, that the piercing cold cannot reach vnto it. Wherefore it heateth the ſtomacke, as cloathes heat the body, not by adding heat, but by keeping the naturall heat in, and exter-

Why there is no fat in or about the braine.

Why melancholy men are leane.

Galen expounded.

How fat heateth the ſtomacke.

Why Fat flames.

nall cold out. That it eaſily flameth, proceedeth from his oyly and aery matter, ſo Camphire burneth in the fire, which yet all men take to be cold.

The concluſion.

Moreouer the effects doe not proue the efficient cauſe of Fat to be hot; for oyle which becomes thick and congealed in winter, preſently taketh flame, and yet no man will deny but that it is congealed by the externall cold of the ayre. We therefore conclude that Fat is curdled by cold, that is, by a lower or more remiſſe degree of heate, & that it groweth or adheareth onely to membranes, becauſe their heate is weaker, as hauing no continuity with the heart, and therefore depriued of that plentifull influence of heat therefrom, which the other parts of the body doe inioy which haue a more notable continuity with it.

Whether Fat be a liuing and animated part of the body. QVEST. VI.

Authorities to proue the fat to bee a liuing part.

THey who imagine that Fatte is curdled or congealed by heate, beare themſelues much vpon this argument, that no true part of the body is condenſed by cold; now ſay they, Fat is a part & a liuing part of the liuing creature; this point we cal into queſtion. It may I confeſſe be made probable both by authorities and by arguments. *Galen* in his Cõmentaries, reckons it among the

In lib. Hip. de natura hominis

ſimilar parts; and in another place he ſayth, it euery where performeth the ſame office as the Veines, Arteries, and Sinewes; if it performe any office to the body, then certainely it is a liuing part. Againe, in another place where he reckoneth vp foure differences of parts, he reckoneth the Fat among thoſe that are gouerned by themſelues. In his booke of the

Lib. 6. de placit. cap. 8.

differencies of diſeaſes, hee ſayeth that the number of the parts is abated, if the Arteries, the Veines, the Nerues, the Fleſh, and the Fat, be not counted among them. In his book of the *vnequall Tempers* the parts of the Fingers and Toes are theſe, the Bones; the Cartilages, the Ligaments, the Arteries, the Veines, the Fleſh, the Skin, the Fat. And the authorities may be ſeconded by arguments; The Fat groweth and is augmented to a certain *terminus* or extent, and in ſome creatures it hath alwaies a certaine ſeate and figure, therefore it is a part. Moreouer it groweth white by the faculty or power of the Membrane, that altereth and aſsimulateth the bloud: nowe this alteration and aſsimulation is wrought onely by the power of the ſoule, and of naturall heate. And againe, in the middle of this Larde are found certaine kernels which could not be generated in the Fat, had it not the forming faculty inherent therein. For the vntying of this knot we muſt know that there is a twofold acceptation of a part, one more large, the other more ſtrict. In the large account, whatſoeuer addeth any thing to the accõpliſhment of the whole, may be called a part of the whole which it helpeth to accompliſh. In which reſpect the Fat deſerueth the name of a part, as alſo the Haires, the Nayles, the Marrow, the Bloud, yea and milke it ſelfe. But in the more preſſe and ſtrict ſignification, the Fat cannot be called a part, becauſe it neither partaketh of a common life, as wee ſay, neither hath it any proper figure or circumſcription. And moreouer as *Galen* witneſſeth, in famine and want of nouriſhment it may bee conuerted into nouriſhment: now one part cannot nouriſh another, but all parts that enioy common life, haue alſo one common nouriſhment, either immediate or mediately. Adde to this, that it is neither ſpermaticall nor fleſhy part; not ſpermatical, becauſe it appeareth not in the firſt delineation of the parts; not fleſhy, becauſe all fleſhy or bloudy parts are red; and therefore it is no liuing part partaking of the liuing ſoule.

Answered.

A twofold Part.

Arguments that it is no animated part.

Galen.

Anſwere to the authorities.

Concerning the places alleadged out of *Galen*, where he calleth it a ſimilar part, hee vſeth the name of part, in the larger ſignification; where he ſayth it is the author of a function, or performeth an office: by office or function he meaneth a vſe. For *Galen* often confoundeth an action and a vſe, although there is great differẽce between them; for the haires haue a vſe, yet they performe no office or action. Whereas they obiect that it is increaſed; we grant it, but how? by appoſition onely, as the haires alſo grow and encreaſe, not by aſsimulation of Aliment as other parts doe: and therefore it onely increaſeth ſo long as it hath matter, when the matter ceaſeth, as in old age it doth, then it ceaſeth to be generated.

Why haire & fat grow not in old age.

The whiteneſſe of the Fat ſay ſome, is acquired not by the forming faculty, but by cold; as all phlegme is white, whoſe efficient cauſe is colde. I thinke the whiteneſſe comes by a light alteration which the bloud hath from the membranous parts. For when as any notable quantity of bloud falleth vpon the membranes, it receiueth indeede a light rudiment of alteration from the power or faculty of the membrane; but becauſe the quantity is greater then can bee aſsimulated, and yet it is impacted about the membranes, it is condenſed by their weake heate; but is not changed into the nature of the part where it is condenſed:

How the fat becomes whitiſh.

ſo

ſo that if it be a part, it is but an imperfect part; and this *Ariſtotle* perſpicuouſly diſcerned in his Booke of Parts, where he ſaith, that there is this difference betweene fleſh and fat: that in the generation of fleſh the blood is ſo throughly laboured and mitigated, that it is turned into a part partaking of ſenſe; but in the generation of the fat, the bloode is indeed changed into a part, but that part is not capeable of ſenſe.

The laſt argument may thus be anſwered. The Kernels which are found among the Fat, are not generated by the fat, but haue a delineation, though not conſpicuous in the firſt forming of the parts, and afterward the fat encompaſſeth them or groweth about them: or it may be ſaide that thoſe kernels are generated by the heate of the adiacent parts, not of the fat. And theſe are the queſtions which are controuerted concerning the skin and the fat.

QVEST. VII. *Of the Membranes, vſe, and productions of the Peritonæum.*

CONcerning the Rim of the belly, there is ſome difference betweene the Ancients and the later Writers, yea and amongeſt the Neoterickes themſelues. The Ancients thought it was a ſingle and ſimple Membrane, becauſe in Diſſection it appeareth to be very fine and thin like a Cobweb. *Columbus* ſaith, that it is ſingle onely from the Breſt-blade to the Nauill, and double from thence to the Share, and that becauſe of the vmbilicall veſſels which are carried through the duplicatiō. *Laurentius* ſaith, he hath alwayes obſerued it double euery where; aboue and below; before & behind; on the right hand and on the left, and auoucheth that all Membranes of the body euen the *Pia mater* or thin Membrane of the Braine, are alwayes double. For ſaith he, as below betweene the duplication of the *Peritonæum*, there ariſe two Arteries and the *Ourachos* vnto the Nauell, ſo from the Nauell to the Liuer paſſeth the vmbilicall vein betweene the ſame duplication aboue; and therefore wondereth at *Columbus*, who was ſo occulate an Anatomiſt, and yet did not obſerue ſo much. *Galen* obſerued a third vſe of the *Peritonæum*, which is to preſſe the guts, and to driue downe the excrements of the Belly. This vſe *Veſalius* derideth: for how can it haue this vſe (ſaith he) when it hath no voluntary motion of his owne, whereby it can contract and diſtend it ſelfe? by the ſame reaſon, the *Pleura* ſhould helpe the Midriffe in the contraction of the Cheſt. We anſwere for *Galen*, that he doth not intend that the *Peritonæum* doth this by his owne proper motion, or by it ſelfe, but onely by accident and euent. As when the Muſcles of the *Abdomen* and the Midriffe like hands ioyned aboue, and open below, doe preſſe and driue downward that which is ſtraightned in the middeſt betweene them, then the *Peritonæum* which holdeth theſe two in their proper poſitions, maketh the preſſure more forcible.

Columbus.

Laurentius.

All the Membranes of the body are double.

Galens 3. vſe of the *Peritonæum* derided by *Veſalius.*

Galen expounded.

Veſalius beſide denies, that there are any productions of the *Peritonæum* in Woemen, becauſe their Teſticles do not hang downe, but are truſſed vp to the ſides of the wombe; but he obſerued not that theſe productions reach in woemen to the Leske, and become the *Cremaſteres* of the wombe; and that there are the ſame holes or paſſages in the Tendons of their oblique deſcendent Muſcles which are in men; whence it commeth to paſſe, that woemen are often troubled with the *Boubonocele.*

Why women are ſo often troubled with *Boubonocele.*

QVEST. VIII. *Of a new kinde of compunction of dropſie bodies through the Nauell.*

IT ſhall not be amiſſe in this place, to annexe a kinde of Compunction of the Nauell, by which the water is ſafely let out of dropſie bodies. The ancient Phyſitians called all apertions of dropſie bodies παρακέντησιν. In the adminiſtration of which *Paracenteſis*, there ariſe foure Queſtions. Whether it be feaſible; when, where, and how it is to bee performed. That it may be done ſafely, remaineth vnder the Teſtimony of many witneſſes, all beyond exception; and beſide, it may by reaſon be demonſtrated. *Hippocrates* firſt of all other, preſcribes it both in his Aphoriſmes, and alſo in diuers other places. *Galen* in the 14. of his Method, *Paulus* of *Ægina*, *Albucaſis*, and in a word, almoſt all Phyſitians. Beſides Authorities, reaſon alſo addeth her ſuffrage to this attempt. For when theſe reſtagning or gathering waters, can neyther by outward nor by inward Medicines bee euacuated, why

Paracenteſis.

That it is feaſible.

Hippocrates.
Galen.

ſhould

ſhould we not proceede to Section in theſe, as well as in other watery and Flegmatick tumors: eſpecially ſeeing the parts wherein the Section is to bee made, are all ignoble and baſe.

The time for this worke.

The time fit for this apertion, *Hippocrates* elegantly deſcribeth, where he ſayth, *Dropſie bodies muſt preſently be cut, and thoſe that are Empui, preſently burnt.* This *preſently*, *Hippocrates* himſelfe interpreteth to be *out of hand*, or *in the beginning of the diſeaſe*: *Galen* ſaieth, it muſt be *before the inward parts are corrupted*; for the water is in vaine let out, if the entrals be vitiated, eſpecially any thing notably; becauſe it wil inſtantly and continually gather againe: ſo then it is a foule error in a deplorate or deſperate dropſie, to vndertake this kind of cure, becauſe (as *Celſus* very well ſaith,) it is a kinde of impiety in Art raſhly or inconſiderately to prophane ſuch remedies, as being rightly vſed may be of great auaile. The

The place.

third queſtion is concerning the place for this apertion. *Paulus* and all Phyſitians after him, euen to theſe times, adminiſter this Section a little below the Nauell towardes the ſides, becauſe of the *Tendons* or *chordes* of the Muſcles: and that on the ſide that is oppoſite to the part affected; as if the liuer be affected on the left ſide, if the Spleen on the right. That

Aponeuroſis.

kind of ſection is not to be diſcommended, yet *Laurentius* thinketh, it may bee more commodiouſly done through the very Nauell, and for his opinion bringeth very rare obſeruations, and ſtrong reaſons.

Laurentius his new conceite eſtabliſhed,

Antonius Benncuenius recordeth, how a certaine Dropſie Patient being giuen ouer by the Phyſitians, by a raſh and caſuall aduenture recouered his health. For, when hee was exceedingly dry (as is vſuall in that diſeaſe) and in deſpaire of recouery, hee powred in an abundance of water, whereupon his Nauell ſuddenly opened whence iſſued ſo great quantity of the dropſy Lie, that his body fell to the wonted ſcantling, and he being aſsiſted by a diſcreete Phyſitian, recouered his health.

By Hiſtories.

I ſaw (ſaith *Laurentius*) at *Monpelier*, a dropſie Woman, whoſe Nauell in a tempeſtuous night, when ſhe thought little of it, opened, whereout flowed a great ſtreame of water: earely in the morning I was ſent for, together with *Bartholmew Cabrolius* a skilfull Anatomiſt: we found her ſpirits almoſt ſpent by reaſon of the ſudden and immoderate euacuation; thoſe we preſently gaue order to refreſh and re-eſtabliſh, which being done, ſhe perfectly recouered through Gods helpe, and yet continueth in good health.

Gratianopolis.

Ludouicus Villonouanus a verie learned Phyſitian, tolde me at *Gratianopolis*, (ſaith *Laurentius*, that he knew a Countrey peaſant perfectly cured by this kinde of ſection. *Balthazar Garielus* my friend, and a learned Chyrurgion of *Mompelier*, at my appointment, ſaith the ſame *Laurentius*, opened after this manner a dropſie patient, who was very importunate vpon vs; his Belly fell almoſt vnto the accuſtomed extent, and he ſeemed to bee paſt all feare of death. The tenth day after his Section, without any knowledge, hee ate a pound of Cherries, hereupon he fell into a ſcowring, by which the frame of Nature was vtterly ouerthrowne, and ſo within two daies he dyed.

By reaſons.

It is manifeſt therefore by experience, that this way ſection may be ſafely adminiſtred: neyther doth reaſon diſſwade from it. For, as *Hippo.* ſayth, *The way that Nature inclineth the Phyſitian muſt follow*; but Nature oftentimes findeth this way through the Nauel Beſide, this kinde of apertion of the nauell, excuſeth the ſection of many parts. For, about the nauell, do meete the foure nauell veſſels, which if they chinke or cleaue, as they vſe to do by the forcible confluence of water to that part in dropſie bodyes, then there remaineth nothing to cut, but onely the skinne, and then the water will yſſue foorth. But it will

Obiection.

bee obiected, that the *Chords* or *Tendons* of all the Muſcles of the *Abdomen*, do meete about that place, and therefore if that place bee wounded, it is a venture but Convulſions

Anſwere.

will follow. Wee confeſſe indeede, that all the extreamities of the Muſcles do determine in the white line, but theſe extreamities about the nauell are perforated, to make way for the vmbilicall Veſſelles, and therefore are not wounded in this kinde of apertion. Moreouer, thoſe which labour of that kinde of Dropſie which is called *Aſcites*, almoſt all haue ſtrutting or ſwollen nauels, the tumour growing by reaſon of the confluence of water to that part, ſo that if but the skinne bee pierced with a ſnarpe inſtrument, then preſently followeth a flood of waters. Againe, when the ſection is thus made in the middeſt, the patient may with eaſe lye vpon either ſide, which he cannot do if the other kinde of ſection be

The manner how to adminiſter this kind of apertion.

adminiſtred.

The laſt queſtion, was mooued about the manner of this kinde of *Paracenteſis*, which is on this ſort. You muſt firſt caſt a bought or running knot round about the nauell, that at

your

your pleasure you may streighten the hole or passage, if the water should yssue out with too great violence; next, with a sharpe poynted Nall or Bodkin, you must pierce the skinne in the verie middle of the knot of the Nauell, against which as wee haue said, the Vesselles doe chinke or cleaue in Dropsie bodyes; and then put a Brazen or Siluer pipe into the wound, through which the water may passe, which also may bee stopped at your pleasure: for all the water must not at once bee drawne out, but some and some by degrees. For *Hippocrates* saith, *That if the Dropsie water, or the purulent Matter of an empyeme in searing or cutting do all at once yssue foorth, the Patient will dye*: For, it is a rule, *That all plentifull and sudden euacuations are dangerous*. And in another place, *Dropsie Waters must be by degrees euacuated*. Finally, it may seeme, that *Hippocrates* had some knowledge of this kinde of apertion, because hee saith in one place, *Apply your actuall Cauterie about the Circumference of the Nauell, to let out the dropsie water, but burne not the part too deepe*. Haply least they should not be able to moderate the effluxion.

Caution.

Aphor. 27. sect. 4
Apho 51. sect. 2

De morbis internis.
De locis in homine.

(:**:)

The End of the Controuersies of *the Second Booke.*

THE THIRD BOOKE,

Of the Parts belonging to Nutrition or Nouriſhment.

The Præface.

HAuing in the former Booke diſmantled this Caſtle of the Bodye, and particularly the lower Region, wee are now arriued at that worke-houſe of Nature, wherein ſhee hath built her Engines and Inſtruments by which ſhe doth not onely nouriſh and ſuſtain the whole Family, but alſo perpetuate *Mankinde* by Propagation; the deſtiny of the matter not admitting a perpetuity in the particular creature. But becauſe theſe two workes of Propagation and nouriſhment are altogether diſtinct, if not in the Faculties being both naturall Alterations; the one called Generation, the other Aſsimulation; yet in the parts and Organs thereto belonging: wee haue alſo thought good to diuide them in our Diſcourſe; and referring the worke of propagation to afterward, in this place onely to handle the parts ſeruing to nutrition or nouriſhment.

Seeing therefore the ſubſtance of the whole body hath a neceſſary diffluence and diſsipation, as well by the in-bred heate, which like the greene worme feedeth vpon the choiſeſt gemmes and flowers euen the Radical moiſture, as alſo by the outward aire, and other externall cauſes, and therefore cannot poſsible either encreaſe to the iuſt extent or conſiſt when it is growne, vnleſſe the detriment and ſcath which is ſuſtained by ſuch diſsipation and diſſolution bee reſtored and made good: Nature hath prouided certaine nouriſhing Organs, whereby that daily expence is continually ſupplied. And heerein we haue to admire the wonderfull prouidence of the great Creator, who hath diſpoſed theſe parts wherin it was neceſſary there ſhould be ſuch a confluence of noiſome excrements in the loweſt place, as it were in the ſinke of the body, leaſt otherwiſe their offenſiue exhalations ſhould defile the braine and the heart, which are the ſeats of the principall faculties, or vitiate and diſturbe the reſt of the ſenſes. For this lower Region, is as it were the kitchen of the houſe, in which there are ſome parts, which as Cookes do prepare the common diet for the reſt. But in the deſcription of this Region, it muſt be remembred that we muſt not follow the order of dignity, or of nature, but of diſſection, taking the parts according to their poſitiõ.

The eie therefore falleth firſt of all into the ſnare of the kell, and indeede it is of all things moſt like to a ſnare or purſenet, the cloſe Meſhes whereof, are purfled with curled veines and curdled or criſped fat, ſo becomming a thrummed rugge to keepe warme the Membranous and vnbloody guts and ſtomacke vnder it. As for his duplication, wherein the ſnaking and ſnayling diuarications of the veſſels do craule all ouer the belly, I ſuſpect it to haue bin ordained by nature, for ſome more ſecret and myſticall end, then the ſecuring of thoſe tender ſaplings, albeit I reſt heerein vnſatisfied for any thing I haue read.

Immediately vnder theſe Cipreſſe wings (for wings they are called by the Anatomiſts) or Cauly cobwebs, appeareth the Maze or labyrinth of the guts wheeled about in manifold foulds & convolutions, that neither the aliment ſhould ſo ſuddenly paſſe away, and ſo the wombe of man become an inſatiate Orque voyding whilſt it doth deuour, neyther yet the noiſom ſteame of the Fæculent excrements haue free and direct aſcent to the vpper parts, but be intercepted and deteined within thoſe Meanders, & ſo ſmothered in thoſe gulphs of the

the Guts, or let out at the port Eſquiline. In the middeſt of the Guttes is ſcituated the Meſenterie, which we may call not the Midriffe, but the Midruffe, for it is moſt like vnto a gathered ruffe, ſuſtayning the winding reuolutions of the Guttes in their proper places, and conuaying vnto them the Meſeraicke veines, by which as by tender bearded rootes, the Aliment is conuayed vnto the gate of the Liuer: ſome haue called them *Baiuli domus*, the Porters of the houſe, becauſe they continually carry the Aliment vnto that furnace, where it is tryed into bloud. Neither are they idle and rigid paſſages, but as *Homer* feigneth that the inſtruments of *Vulcan* are moued by inſtinct and of their owne accord, ſo we may ſay that theſe veſſels are taught by their Creator, not onely to leade along the *Chylus*, but to draw it and prepare it for the Liuer.

Next appeareth the *Pancreas* which we call in Swine the Sweet-bread, a rude and vnſhapely lumpe, moſt like a map or diſh-clout, both in faſhion and vſe; or if you would liken it to any thing in the body, then it neareſt reſembleth the Liuer or cake of the wombe, which groweth to the rootes of the Infants nauell. It ſerueth for a pillow or Cuſhion, to boulſter vp the manifold diuiſions of the Veines, Arteries, and Sinewes, which in that ſeat of the body are diſtributed vnto the adiacent parts; beſide many other vſes which we refer vnto their proper place: and paſſe along vnto the ſtomacke, the Cooke-roome, where Diet is the Steward, Appetite the Clark, and Concoction the maiſter Cooke. From thence the viands are deliuered vnto the Liuer, the principall part of this lower region, wherein they attaine their vttermoſt perfection, being depurated, from the ſcum by the bladder of Gall, from the reſidence by the ſpleene, from the vnprofitable liquor by the kidneies, which conuay it vnto the Ceſterne of the bladder, to be caſt out by the Conduite. Of all which if I ſhould in this place vndertake to diſcourſe, as it were eaſie for mee, though briefly as I began, yet the ſhortneſſe of the partes I ſee would amount vnto too long a ſumme to bee comprehended in a Preface, eſpecially conſidering wee ſhall at large proſecute euery particular in the following diſcourſe: wherefore after we haue giuen you another kinde of diſtribution of them in the Chapter following, we will apply our ſelues vnto their particular Hiſtories.

CHAP. I. *A diſtribution of the naturall parts contained in the lower Belly.*

HAuing already intreated of the Inueſting or Cõtayning parts of the lower region or nether Belly, it followeth now that we continue our diſcourſe to the parts contayned alſo. Theſe are of double vſe, for either they ſerue for nouriſhment, or for generation; thoſe that belong to generation and propagation of the kinde, we refer vnto the next Booke. The nouriſhing parts doe either perfect the Chylus which we call Chilification, or the bloud which wee call Sanguification. For the firſt, ſome make and concoct the Chylus, as the ſtomacke; ſome helpe and further this concoction, as the Kell and the Sweet-bread; others put to the laſt hand of perfection, and then diſtribute it, as the ſmall guts; others receiue and auoyde the groſſe and thicke excrements, as the great Guts, and theſe together with the ſmal, are faſtned vnto the Meſenterie.

The parts belonging to nutrition.
To chilification.
Stomack.
Kell.
Sweet bread.
Guts.
Menſentery.
To ſanguification.
Meſeraicke Veines.
Gate veine.
Liuer.
Hollow vein.
Parts auoyding the excrements.
The bladder of gall.
The ſpleene.
Vas breue.
Hæmorroid veines.
Kidneyes.
Vreters.
Bladder and yarde.

For Sanguification, ſome parts ſucke the Chylus out of the Guts, alter it and giue it a certaine rudiment or tincture of bloud, as the Meſeraicke veines, which alſo carry it by the Port veine, vnto the gate of the Liuer, and thence into the ſubſtance thereof, where it receiueth the perfection of bloud. Others when it is thus perfected, doe diſtribute it into the whole body, as the hollow veine by his faire forked branches. Others receiue the excrements, either yelow choller, as the Bladder of Gall, and that which wee call *Porus Biliarius*, and conueyeth it into the Guttes; or blacke and feculent choler, as the ſpleene or Milt, in which it receiueth a farther concoction, and the more laudable part it reſerueth for his owne nouriſhment, but the very Lees it ſendeth away either vpward vnto the ſtomacke by a ſhort veſſell called *Vas breue*, where it becommeth the Appetites remembrancer; or downward to the *Hæmorrhoidall* veines. Finally, the ſerous or wheyie part of the bloud is ſtill deſtilled away by the Kidneyes, wherein there is a ſegregation or ſeparation made of that whey or vrine from the bloud; the bloud remayning behind for the nouriſhment of the Kidneyes, but the whey is deriued by the vreters into the bladder, from whence

whence it is deliuered out by the Conduite.

Of all which parts we will entreat as I ſaid before, according to the order of Diſſection, beginning with the Kell or *Omentum*.

CHAP. II. *Of the Omentum or Kall.*

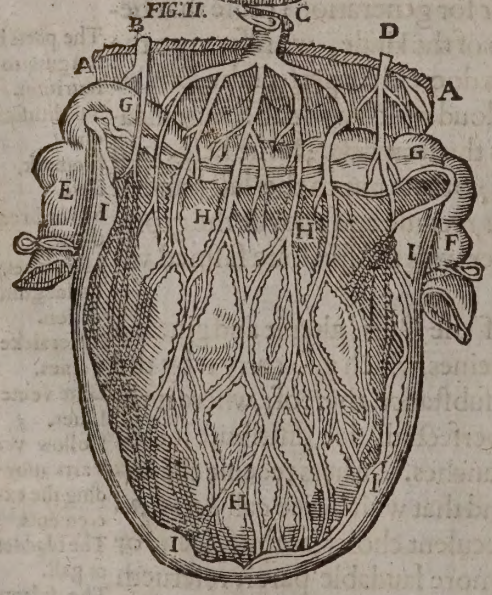
The names & the reaſons of them.

THE Kall or Kell which is deciphered in the ſixt Table of the ſecond booke, and in the firſt and ſecond of this third booke, is called *Omentum*, as it were *operimentum*, that is a couering: of the Greeks ἐπίπλοον of ἐπιπλέω to ſwim vpon, becauſe it ſwimmeth vppon the bottome of the ſtomacke [Table 2 bb] and the vppermoſt guts [Table 2 cc.] From the wandring and implicated paſſages of his veſſels, which may be likened to a fiſhers net [Table 1. Figure 1. and 2.] it

Table 1. Lib. 3. The firſt figure ſheweth the Kall or Omentum, whole and looſed on euery ſide, reſembling a Satchell, or a ſmall fiſhers Net, with the courſe of the Veines, Arteries, & Sinewes, running through it. The ſecond figure contayneth the lower membrane of the Omentum, the vpper being remooued with the Collicke gut which it contayneth and the veſſels.

FIG. I.

FIG. II.



aaaaaa. The outward face of the vpper membrane of the Kall.

bbbb. The circle or girdle of the kall at which it growes.

ccc. The vpper part of the lower membrane aboue the colon.

def. Sheweth the membrane, veſſels, and fat of the *Omentũ*.

g. The trunke of the gate veine where it commeth out of the Liuer.

h. An arterie with a nerue reaching to the hollowneſſe of the liuer, and the bladder of gall.

i. A veſſell comming to the *pylorus*, eſpecially on the back-part, hauing an artery his cõpanion.

kk. A veſſell with a nerue which goeth to the right bottom of the ſtomack.

llmm. Braunches inwrapping the body of the ſtomacke from a veſſell marked with *k* which alſo goe through the vpper mẽbrane of the kal *mm*.

n A veſſell reached out to the *duodenum*, and to the beginning of the empty gut, oftentimes hauing a ſmall nerue to beare him company,

o The diuiſion of the gate veine into the right and the lefte branch.

p The right branch running into the *meſẽterium* & the guts

q *A* veine going to the backe-parts of the ſtomacke.

ſ *A* veine imbracing the lefte mouth of the ſtomacke, in manner of a crowne.

t The artery of the meſentery.

u *An* artery going to the lower mẽbrane of the kal,

x *A* veſſel ſent with a nerue to the colon and to the lower membrane of the kall.

x *A* veſſel going to the lower *Omentum*.

yy The courſe of the veſſels of the ſpleene from the ſpleenicke branch.

z *A* branch reaching to the left bottom of the ſtomacke.

aaaa The *Pãcreas* or ſweetbread vnder the veſſels and the *duodenum*.

The ſecond Figure.

AA The vpper part of the lower kal ariſing from the back, which behind is vnder the ſtomacke, & with twoe membranes comprehendeth or embraceth the colon at the bottom of the ſtomack.

B *A* veine comming from the left trunk of the gate veine and the arterie, with a nerue for the moſt part tied vp to it, going into the kall.

C *A* notable veine and an arterie communicated to the kall and the collicke gutte, to which a ſmall nerue is added in ſome ſteads,

D *A* veine running along the left ſide of the kall. E. The right ſide of the collicke gut which lyeth vnder the hollownes of the liuer here cut away. F. The left ſide of the collicke gutte which lyeth vpon the ſpleene. GG, *A* part of the collick gut running along vnder the bottom of the ſtomacke. HHH. The lower part of the inner kall ariſing in ſome ſort from the collick gut. III. The remayning portions of the vpper membrane of the kall torne off, that it may be ſhowne how the kall may be compared to a ſatchell or bagge.

is

is called *rete* or *reticulum*, for that ſayth *Archangelus*, as a net intangleth the fiſhes, ſo in this Membrane the Fatty vapours are intercepted and ſtayed. The Arabians call it *Zirbus*, the Latines *Mappa ventris*, the diſh-clout or map of the Belly, becauſe it licketh vp the ſuperfluities thereof. All the ſanguine or bloudy parts almoſt are couered heerewith, but ouer ſome it is more fatty, ouer others more membranous. Amongſt all creatures it is greateſt in Men and Apes; and of Men, thoſe that liue a ſedentarie and idle life, ſacrificing to their appetites, haue it ſo great, that it becommeth a burthen vnto them, whereupon they are called *Epiploocomiſtæ*, that is, Kal-carriers; but thoſe that vſe great exerciſes, as Hunters and ſuch like, haue it more membranous, and leſſe fatty.

Archangelus.

Kal carriers.

It is a large membrane, ſcituated before vpon the bottome of the ſtomacke, [Table 6. [PP] *Lib.* 2.] and downeward ouer the guts [Table 6. [KKKK] *Lib.* 2.] vnto the Nauill. Sometimes, but ſeldome, and that in Apes and Dogges it is ſtretched euen vnto the ſharebone; and vſually in diſſections it is obſerued to bee rowled vp, or doubled towards the ſpleene, not onely in ſuch as are hanged or drowned ſayeth *Veſalius*, but alſo in thoſe that die of other ordinary diſeaſes, or come to their ends by ſodaine miſchances. Sometimes alſo it inſinuateth it ſelfe into the conuolutions or windings of the guts, and ſometimes in Women it paſſeth betweene the bottomes of the wombe and the bladder, and by ſtreightning the mouth of the wombe becommeth an ordinary, but yet not a perpetuall cauſe of barrenneſſe or ſterility, as alſo *Hippocrates* obſerued in his book *de natura Muliebri*. In ſome women after their trauell, it remayneth gathered together about the middle of their Bellies, and there is the cauſe of ſore paynes. But if it fall into the paſſage that deſcendeth into the Cod, it cauſeth a ſoft rupture, which diſeaſe no creature is ſubiect vnto but Men & Apes, as ſayeth *Galen* in the third Chapter of his ſixt booke *de adminiſtrationibus Anatomicis*.

The ſcituation of the Kal.

Veſalius.

Hippocrates.

Galen.

It is faſtned alwayes to the ſtomacke [Table 6. [MNO] *Lib.* 2.] to the Spleen and the Collicke gut [Table 1. Figure 2. [GG HH]] to other parts ſometimes it is ioyned, ſometimes it is free from them, for it behooued not ſayth *Galen* in the 11. chapter of the fourth booke *de vſu partium*; that it ſhould hang looſely, leaſt it ſhould be crumpled together, and ſhould leaue many parts vncouered, which ſtand in neede of his warmth.

His connexion.

The forme of it is likeſt to a Purſe-net or Faulkners bagge, [Table 1. Fig. 1. and 2. [II]] conſiſting of a double membrane knit together in the bottome; *Columbus* ſayth, but only reflexed or turned backe againe. It hath a round *orifice* [Table 1. Figure 1. [bb]] which aſcendeth higher in the hinder part then before, and belowe it is round [Table 1. Figure 1. and 2.]

The forme of it.

It is compounded of membranes and veſſels, and a muddy and eaſily putrifying Fatte, which compoſition *Galen* expreſſeth vnder the name of his originall, in the place next aboue named. The Membranes are two (whence of ſome it is called a double *Peritonæum*) and thoſe very fine and ſmooth (leaſt the guts ſhould bee ouer burdened with his waight) lying one vpon the top of another; the vpper is called the vpper wing, the lower the lower wing [Table 2. [cc].] The vpper and formoſt ariſeth at the bottome of the ſtomacke [Tab. 2. [aa bb].] from the *Peritonæum* which compaſſeth it about, and maketh his third coat, and is ioyned in a right line, with a portion of the inferiour membrane in the hollow parts of the Liuer and the ſpleene. The lower and hind-moſt wing ariſeth from the *Peritonæum* at the backe [Table 1. figure 1. [ccc]] preſently vnder the midriffe; and being led to the hollow ſide of the Liuer, it cleaueth (yet but ſeldome) to a part of it, as alſo to the midriffe, to the right ſide of the ſtomacke, almoſt to the whole gut called *duodenum*, and to the hollowe part of the ſpleene; and groweth faſt to the ſtomacke, and to the collicke gut, [Table 1. figure 1. [GG]] all the way the ſame is annexed to the bottom of the ſtomacke, ſo that to that gut it is as it were [Table 1. figure 2. [HH]] a meſenterie. In Dogs it is neither tyed to the Colon, nor to any other gut; in Apes onely to the right part of the Colon.

The frame or compoſition.

His two membranes.

Connexion.

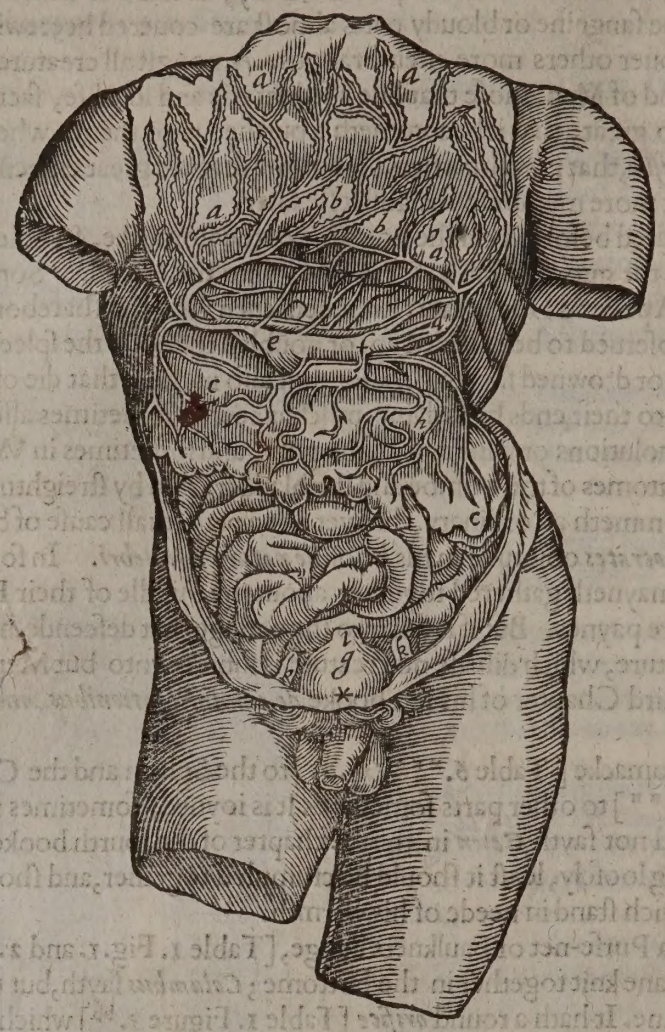
Many veines (but onely from the port veine) paſſe through both his wings. Through the vpper from two veines which paſſe by the bottome of the ſtomacke (which are called the right and the left [Tab. 2. [H] and [X]] *Gaſtra epiplois*) infinitely propagated obliquely downward [Table 1. figure 1. [kk mm].] Through the lower wing from thoſe veines which paſſe into the ſpleene [Table 1. fig. 1. [ii x] figure 2. [B C D]] which are diuerſly ſpread, ſometimes with a foure-fold branch (as in the hiſtory of the Port veine ſhall be ſayd) for the nouriſhment of the adiacent parts.

His veſſels. veines.

They are ſprinkled with ſo many Arteries [Table 1. figure 1. [u] figure 2. [c]] from the Cæ-

Arteries.

TABVLA II.



The lower belly, with the vpper Membrane of the Kall torn vp, and turned aboue the outside of the Cheſt and the ſtomacke; the ſtomack alſo remoued out of his ſeat to the Cheſt, that the lower Membrane of the kall might the better bee perceiued; as alſo the guts remayning in their naturall poſition, and a part of the ſpleen, are herein deciphered.

aaaa. The inſide of the vpper membrane of the kal, which ſome call *alam ſuperiorem* the vpper wing.

bb. The ſtomack ſtrutting out couered with the vpper membrane of the kall.

cc. The lower membrane of the kall, or his nether wing gathered vpward.

d Veſſels paſsing to the ſpleen which appeareth bunching vnder the *Omentum* at *h*.

e The trunke of the gate vein.

f The ſpleenick branch of the port veine.

g The bladder of vrine.

h The ſeate of the ſpleen.

i The veſſels called *Vrachos*, by which the Infant is nouriſhed in the wombe.

kk The 2. vmbilicall arteries.

liacall & meſenterical branches to giue them life; but their nerues from the Ribbe-branch [Table 1. fig. 1.] of the ſixt payre are wondrous ſmall, but finely ſcattered that they might not be altogether without ſence.

Nerues.

The fat of the Kell.

The Fat is very plentifull about the veſſels [Table 1. figure 1. d e f] but in the diſtances betwixt them, none at all. In an ordinary fat man it may amount to a pound, or a pound and a halfe; and amongſt it do runne innumerable glandules or kernels, which ſucke vp the fæculent moyſture, which is ſeparated in the firſt concoction. Wherefore ſeeing it is not ingendered of any portion of the bloud, as that fat called *pinguedo*, or as other fats, therfore it eaſily putrifieth, ſo that if vppon a wound it fall out of the body, it becommeth preſently rotten, which hapneth not to the other fats vnder the skin, or in other parts.

The vſe of the fat of the Kell.

The vſe of the Fat of the Kall, is to cheriſh and to comfort the bottome of the ſtomack, (for the vpper part thereof is warmed by the Liuer which lyeth vppon it, and therefore it is that the Kall attayneth not ſo high) as alſo to increaſe the heate of the guts: for both theſe parts are membranous and without bloud; and therefore their naturall heate is but weake. Now this comfort the Kall affoordeth not onely by his owne heate, which yet is the more, becauſe of the manifolde Veines and Arteries which are wouen together thorough his ſubſtance: but alſo becauſe beeing thicke and bedded together, it much hindereth the heate from diſsipation, and the incurſion alſo of outward colde, and ſo by conſequence is a great helpe and furtherer of concoction. And that it was ordayned to increaſe heate; *Galen* in his fourth Booke *de vſu partium*, and in the ninth Chapter, maketh manifeſt by the example of thoſe, who hauing got a deepe wound in their bellies, ſo that a part of the Kall falleth out, do euer after worſe concoct their nouriſhment, and ſtand in need of Stomachers or other couerings vpon their bellies to keep them warme, eſpecially when much

of

of it falleth out; for it preſently groweth liuid, and conſtraineth the Chirurgion to take it off, ſo ſaith *Hippocrates* in the beginning of his firſt Booke *de Morbis*; *If the Kall fall out, it putrifieth neceſſarily.* And *Galen* in the place before named ſaith, hee tooke almoſt all of it from a Fencer, who was preſently cured, but euer after was eaſily offended with colde, ſo as he was conſtrained to defend his belly with Wooll. Heereto alſo *Ariſtotle* aſſenteth in the third Chapter of his fourth Booke *de partibus Animalium*, *Nature* (ſaith he) *abuſeth the Kall to helpe the concoction of the Aliment, that it might bee done with more eaſe, and greater expedition. For heate concocteth: now that which is fat is hot, and therefore the Kall beeing fat, muſt needs concoct.* *Hippocrates.* A ſtory out of Galen. *Ariſtotle.*

Another vſe of the Kall is to keepe the guts moyſt, becauſe they are often diſtended, & againe corrugated, as they are filled with *Chylus*, or emptied of it againe. A third vſe is, that in time of neceſsity and affamiſhment, ſaieth *Galen* in the xi. Chapter of the fourth Booke *de vſu partium*, it might ſupply a kinde of ſubſidiarie nouriſhment to the naturall heate. *Galen.*

The vſe of the Membranes of the Kall or Kell, is to ſuſtaine the branches of the Gate Veine, and the Caliacall Arterie which paſſe into the Stomacke, the Spleene, the Gut called *Duodenum*, and the Collicke gut. Againe, to knit the ſtomacke, the *duodenum*, and the Collick guts vnto the backe. To couple together the Liuer and the Spleene. The vſes of the Membranes of the Kell.

Archangelus addeth. That the thicke and bloudie vapours ariſing from the parts contayned in the Lower belly, might cleaue into theſe Membranes, and by their denſitie and thightneſſe or faſtneſſe be condenſed or curdled into fat, that ſo good a vapour as might afterward be turned into nouriſhment, ſhould not vapour out in vaine. Finally, *Laurentius* addeth another vſe of the Membranes out of *Hippocrates* Booke *de Glandulis*, That when the humour which commeth from the Guts, is ſo plentifull that it cannot be receyued and aſſumed into the Glandules, the ouer-plus might bee reſerued in the Membranes of the Kell. *Archangelus.* *Laurentius* out of *Hippocrates.*

CHAP. III. *A briefe Deſcription of the Gate-Veine and his Branches.*

NOw becauſe the Branches of the Gate-veine, and the Cæliacall or Stomacke Artery muſt be demonſtrated by order of Diſſection before wee come to the Guts, or elſe they will be offended, I haue thought it not amiſſe to giue you a briefe deſcription of them in this place, referring the larger and more exact diſcourſe vnto the proper hiſtory of the Veins and Arteries. Firſt therefore, the Gate-veine (ſo called, becauſe through it as through a gate the Chylus is conueyed into the Liuer) ariſeth out of the hollow part of the Liuer, betwixt the two ſmall eminencies or ſwellings thereof which *Hippocrates* calleth *Portas* the gates. Some thinke, it is propagated from the vmbilicall Veine which proceedeth out of that cauity. We will diuide it into the Trunke and Branches. The trunk before it is diuided [Tab.3.^{A}] ſendeth foorth two ſmall ſhootes from his fore-part called *Cyſticæ Gemellæ*, or Twin-veines of the Gall, [Tab.3.^{cc}] which paſſe vnto the bladder of Gall. The ſecond is called *Gaſtrica dextra*, the right ſtomacke Veine [Tab.3.^{D}] which goeth vnto the backe part of the ſtomacke, and the *Pylorus* or mouth of the ſame. Why we treat of the in this place. The Original of the Gate-Veine. *Bauhine.* *cyſticæ gemellæ* *Gaſtrica dextra*

The branches are ſome of them vpper, ſome neather. The vpper branches which wee call the roots of the Gate-veine, [Tab.3.^{AAAA}] are diſſeminated through the hollow part of the Liuer, and do make one Trunke [Tab.3.^{BCDE}.] Theſe roots are by *Anaſtomoſis* ioyned with the roots of the hollow Veine.

The nether branches ſhoot out on the right ſide, or on the left, from the right ſide three branches.

The firſt, called *Gaſtroepiploïs dextra*, the right ſtomacke and Kall veine [Tab.3.^{E}] attaineth from the right ſide of the trunke, to the bottome of the ſtomacke, and the vpper membrane or wing of the Kell. *Gaſtroepiploïs dextra.*

The ſecond is called *Inteſtinalis* or the Gut-veine [Tab.3 I.] becauſe it is conueyed vnto the middle of the *duodenum*, and the beginning of the *Ieiunum* or empty gut. *Inteſtinalis.*

The third is called *Meſenterica*, or the veine of the Meſentery [Table 3.^{b}.] which is ſubdiuided into three veines: two on the right hand called *Meſentericæ dextræ*, which are diſtributed into the guts called *Ieiunum*, *Ileon*, *Cæcum*, and a part of the collick gut, where be- *Meſenterica dextra.*

Tab. iii. sheweth the Vena porta, *or Gate-vein with his branches, which he sendeth to the bladder of Gall to the stomacke, to the Spleene, to the Mesentery, and to the Guts.*

TABVLA. III.

1,2,3,4,5. The vpper Branches of the Gate Veine, dissieminated thorough the Caue or the hollowe parts of the Liuer.

AAAA. Their distribution maketh the form of the Liuer.

B. The trunke of the Gate-veine comming out of the hollow part of the Liuer.

C C. The two twin veines of the Gall, called *Cystucæ gemellæ.*

D. The right *Gastrick* or stomacke Veine.

E. The diuision of the trunke of the Port-Veine into two branches.

F. The left branch, which is the vpper, and is called the Spleene branch.

G. The right branch, which is the greater and the lower, called the Mesentericall branch.

H. The right stomack Kal-veine, cald *Gastroepiplois.*

I. The Gut-veine called *Intestinalis.*

K. The lesser stomacke veine, called *Gastrica minor.*

L. The right Kall Veine called *Epiplois dextra.*

M. The sweet-bred Veines, called *Pancreæ.*

N. The great stomack Veine called *Gastrica maior.*

O O. Two Veins of the last named branch, inwrapping the backside of the stomacke.

P. The Bisurcation or partition of the great stomak Veine in the vpper part of the stomacke.

Q. The Crowne-veine of the stomacke called *Coronaria stomachica.*

R. A branch of the Crown-veine passing along the vpper side of the stomack, and giuing branches to the *Pylorus* or mouth of the stomacke.

S. The backward or hinder Kall-veine called, *Epiplois postica.*

T. The diuision of the Splenick branch.

V. The left kall-veine called *Epiplois sinistra*, whose root in the great figure is at V. but his distribution is well shewne in the small figure by V. and T.

X. The left stomack-kall veines, called *Gastroepiplois sinistra.*

Y Z. The veines which runne vnto the left side of the stomack turned backe from them which go vnto the vpper part of the Spleene, and the vpper Z of the two, sheweth the vessell called *Vas breue* or the short vessel, whereby the melancholy passeth out of the Spleene into the stomack, & this is the reason why melancholy people haue alwayes crasie stomackes.

aaaa. Smal branches running through the substance of the Spleene, making the forme of the spleene

b. The right Mesentericke veine.

c. The left Mesenterick. *dddd.* The Meseraicall Veines. *e e* The Veine which belongeth to the Collicke gut. *ff.* Veines belonging to the right Gut. *g g.* The Hemorrhoidall Veynes which compasse the Fundament; but these shall bee more liuely described heereafter.

The Meseraik Veines.

comming verie slender and fine like bearded roots of a tree; they make those veines which we commonly call the Meseraick veines [Tab. 3. dddd] which passe between the two membranes of the Mesentery, and gaping with open mouth at the coate, not at the cauity of the Guts; do sucke from them the *Chylus*, to which they affoord a certain rudiment or beginning of bloud, and then conuey it to the Liuer, or rather into the rootes of the *Porta*, which are dissieminated in the Liuer. From whence a part falleth out into the substance of the Liuer for his Nourishment, the rest is driuen into the hollow Veine, to be communicated to the whole body. Moreouer we must know, that the very same Meseraicke veines which carry the *Chylus* thus vnto the Liuer, do also bring from the Liuer vnto the Guttes, perfect bloud for their nourishment at the very same time; the Veines of the Liuer drawing the *Chylus*, and the Gut drawing the blood.

Mesenterica sinistra.

The third Mesenteriall Veine, is called *Mesenterica sinistra*, and is dissieminated into the left [Tab. 3. C.] and middle part of the Mesenterie. From this commeth the *Hemorrhoidalis interna*, the inward Hemorrhoidall Vein, [Tab. 3. gg] (for the external proceedeth from the Hypogastricall branch of the Hollow Veine) and descendeth by the end of the Collicke [Tab. 3. ff] vnder the right gut, whose extremity it compasseth with small Tendrils, by which the Hemorrhoides do flow. And thus much of the branches which proceede out of the right side of the trunke of the Gate-veine.

The Hemorrhoid Veines.

Ramus splenicus

Out of the left side issueth the splenick bough, and from it many propagations, some before

fore, ſome after his diuiſion: before his diuiſion ſpring fiue branches.

The firſt called *Gaſtrica minor & ſiniſtra*, the leſſer and left ſtomacke veine [Table 3. [k]] goeth vnto the back part of the ſtomacke. *Gaſtrica minor.*

The ſecond called *Gaſtrica maior* [Table 3. [N]] creepeth vnder the ſtomacke to his vpper *orifice* with three branches; the middle of which is called *Coronaria Stomachica*, the Crowne veine of the ſtomacke [Table 3. [o]] becauſe it doeth incompaſſe the vppermoſt mouth thereof. *Gaſtrica maior.*

The third is called *Epiplois dextra*, the right Kell veine [Table 3. [L]] this attayneth vnto the right ſide of the lower wing of the Kell, and to the Collicke gut. *Epiplois dextra.*

The fourth called *Epiplois poſtica*, the backward Kell veine [Table 3. [s]] paſſeth with a double branch, one on the right hand, another on the left, to the vnder wing of the *Omentum* or Kell, and a part of the Collicke gut. *Epiplois poſtica.*

The fift is manifold, called *Pancreæ* [Table 3. [M]] becauſe like ſmall haires they paſſe vnto the *Pancreas* or ſweet-bread; and theſe are the braunches which doe iſſue before the diuiſion. *Pancreæ.*

After the diuiſion from the vpper braunch neere the ſuperior part of the ſpleene, ſpringeth a notable veine, commonly called *Vas breue*, the ſnort veſſell [Table 3. [z]] which is inſerted into the left ſide of the bottome of the ſtomacke, by which the melancholy bloud is belched out into the mouth of the ſtomack, to ſtrengthē it by his adſtriction, to further the principall action of the ſtomacke which is concoction, and to prouoke appetite. *Vas breue.*

From the lower branch proceed two veines: the firſt called *Epiplois ſiniſtra*, the left kel veine [Table 3. [y]] which paſſeth to the left ſide of the lower wing of the *Omentum*. *Epiplois ſiniſtra*

The ſecond is called *Gaſtro epiplois ſiniſtra*, the left ſtomacke and Kell veine [Tab. 3. [x].] It ioyneth it ſelfe with the right, and compaſſeth the bottome of the ſtomack; the remainder of them both after their copulation, is diuerſly diſtributed [table 3. [yz]] into the middle line of the ſpleene: and ſo much of the Gate veine and his branches. *Gaſtro epiploïs ſiniſtra.*

Of the Arteries called Cæliaca, and Meſenterica; that is, the Arteries of the Stomacke, and the Meſenterie which accompany the branches of the Gate veine. CHAP. IIII.

THE Arteries which accompany the braunches of the Gate veine before deſcribed are three. The firſt is called *Cæliaca*, or the ſtomacke Arterie [Table 4. figure 1. [m]] and the other two, *Meſenterica ſuperior*, or the vpper *Meſenterical* Arterie [table 4. figure 1. [ζ].] and the lower [table 7. 10.] called *Meſenterica inferior*.

The *Cæliacall* or ſtomacke Arterie [table 4. figure. 1. [m] and table 7. 6] is ſo called becauſe it ſendeth many branches to the ſtomack. It is a notable branch of the great Arterie, and euery where accompanieth the braunches of the Gate veine. His originall is from the foreſide of the *Aorta*, where it leaneth vpon the back-bone, and is ſupported with the lower wing of the Kell, till it come to be diuided into two braunches: the right [table 4. figure 1. [n]] is leſſer, and the left [table 4. figure 1. [u]] ſomewhat larger. *Cæliaca.*

The Right branch [table 4. figure 1. [n]] as it goeth vpward to the hollowneſſe of the Liuer, ſheddeth ſmall ſurcles out of it ſelfe, ſome from his vpper part, and ſome from his lower. The right branch.

From his vpper part two: Firſt, the right *Gaſtricke* or ſtomacke Arterie [table 4. figure 1. [p]] is diſtributed into the lower part of his right *Orifice*. Secondly, *Cyſticæ gemellæ* [table 4. figure 1. [r] figure 2. [x] table 7. [x].] two ſmall Arteries creeping to the bladder of gall. *Gaſtrica dextra.* *Cyſticæ gemellæ.*

From his lower part three: Firſt, the right Kell Arterie [table 4. figure 1. [o] figure 2. [h]] attayning to the right ſide of the Kell and the Collicke gut. Secondly, the gut Arterie [tab. 4, figure 1. [q] figure 2. [d]] to the *duodenum* and the beginning of the *Ieiunum*. Thirdly and laſtly, the right ſtomacke and Kell Arterie [table 4. figure 1. [r]] which is faſtned to the vpper Kell, and ſprinkleth many branches to the foreſide and backeſide of the bottome of the ſtomacke. *Epiplois dextra.* *Inteſtinalis.*

That which remayneth of the right branch, determineth in the hollow of the Liuer [tab. 4. figure 1. [y] table 7. [7]] by which it receiueth life. *Gaſtro-epiploïs dextra.*

The left branch [table 4. figure 2, [v]] called *Arteria ſplenica*, paſſeth obliquely through the *Arteria ſplenica*

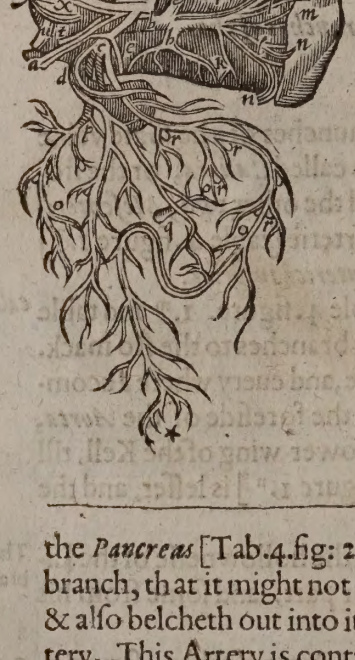
Table iiij. sheweth a part of the Trunke of the great Arterie, out of which the Arterie called Cæliaca proceedeth; and beside it sheweth the branches of the Cæliacall Arterie, which do accompany the Branches of the Gate Veine.

The second Figure sheweth the mutuall connexion of the Cæliacal Arteries, with the sweet bread and the spleene.

TABVLA IIII.

FIG. I.

FIG. II.



g The arterie belonging to the short vessell which passeth from the spleen to the stomack, called *vas breue arteriosum.*

m The place where the *Cæliacall* arterie ariseth.

n The right branch of the *Cæliaca.*

r The right Kal arterie, as it is disseminated into the lower membrane of the Kall.

p The right stomacke arterie running into the right side of the back of the stomack toward the *Pylorus.*

q The gut arterie which reacheth to the gut called *duodenum,* and to the beginning of the *Ieiunum* or empty gut.

r The right stomacke-kall arterie which is disseminated into the right side of the bottome of the stomacke, and into the vpper membrane of the kall.

ſ The two twin arteries of the gal, how they passe vnto it.

t Arteries distributed into the hollow part of the Liuer.

u The left braunch of the *Cæliaca* or *Aluina,* which goeth especially to the spleene.

x The greater stomacke arterie which goeth to the hinder side of the stomacke, and to his left *orifice.*

y Certaine shootes sent into the middest of the stomacke where it is tyed to the backe.

z The Crowne arterie of the stomacke, which circleth the left *Orifice* of the stomacke.

a The left stomacke arterie which goeth into the vpper parts of the stomacke at the right *orifice.*

β The back or hindmost Kall arterie, which is distributed into the lower membrane of the Kal and the collicke gut.

γ The left kall artery which goeth to the lower membrane of the kall.

δδ Branches which passe into the hollownes of the spleene.

ε The left stomack Kall arterie going to the left side of the bottom of the stomacke, and the vpper membrane of the kall.

ζ The vpper mesentericall artery.

ηθ The right and the left emulgent arteries as they goe to the Kidneyes.

ικ The right and the leste spermaticall arteries

The second Figure.

aa The veine, the arterie, and the nerue, which fould themselues in the *Pylorus* or mouth of the stomacke.

b The lesser braunch of the Gate veine, or the spleenick branch.

c The greater branch of the Gate veine or the mesentericall branch.

d A veine and an arterie going to the gut called *duodenum.*

e Vessels going to the lower membrane of the Kall.

f The roote of the arterie which accompanieth the braunches of the gate veine.

g The *Coronarie* or crowne veine & arterie of the stomacke.

h Vessels going to the lower Kall, and to the collick gut.

i The sweet bread or *Pancreas* vpon which the vessels are for security distributed.

k A veine going to the left side of the lower Kal.

ll A company of vesselles which passe vnto the spleen.

m The insertion of these vessels.

nnn Vessels reflected from the former, & offered to the stomack.

ooo Veines and arteries sent to the guts.

pq Two arteries going to the mesentery.

rrrr The glandules or kernels of the mesentery, which lie vnder the vessels for their security.

t The trunk of the gate veine.

u The hole of the bladder of gal where it openeth into the gut called the *duodenum.*

x The veines of the bladder of gal.

y Arteries and nerues that go to the liuer & the bladder of gall.

ϕ Two braunches which run vnto the back parts of the stomack.

* The *Hæmorrhoidal* veine & artery

the *Pancreas* [Tab.4.fig: 2.ⁱ] to the Spleene. [Tab.4.fig: 2.ᵐ.] It is larger then the right branch, that it might not easily be obstructed; for it conueyeth vitall spirits to the spleen, & also belcheth out into it the more fæculent part of the bloud contained in the great Artery. This Artery is continually ioyned vnto the splenick veine described in the Chapter going before, and hath so many branches, and in the same order of position, as also named by the same names, which we will runne breefely ouer in this place.

Before the diuision *from his vpper part* proceede.

Gastrica sinistra. *Gastrica sinistra vel minor*, the left or lesser stomacke Artery [Tab. 4.fig.1.ᵃ] turneth on the right hand to the vpper parts of the stomacke.

Gastrica maior *Gastrica maior* [Tab.4.fig.1.ˣ] offereth a branch to the backside of the stomacke, as also to the midst thereof marked in the fourth Table at [ʸ]; out of this also ariseth the crowne Artery [Tab.4.fig.1,2.] answering the crowne veine before described.

From the lower part.

Epiploïs postica. *Epiplois postica* [Tab.4.fig.1.β. fig.2.ᵉ] diuided into two stradling branches, which are propagated into the lower wing of the Kall and the Collick gut thereto adioyned.

Epi-

Epiplois ſiniſtra [Tab.4.fig:17]paſſeth alſo to the lower *Omentum*, and runneth in to the left ſide thereof. *Epiplois ſiniſtra*

The remainder of this branch [Tab:4.fig: 1ª] attaineth to the Spleene, and is diuided into an vpper and a lower branch, and theſe into others, till at length they reach vnto the hollow ſide of the Spleene, [Tab.4.fig:1,] From whence do proceede *Gaſtroepiplois ſiniſtra*, [tab.4.fig:1] which is ſuſtained by the vpper wing of the Kell, and ſo goeth vnto the left ſide of the bottome of the ſtomacke. *Gaſtro epiplois ſiniſtra.*

Alſo *Vas breue Arterioſum* [Tab.4.Fig.1.7]paſſeth out of the vpper part of the Spleen, and is inſerted into the left ſide of the ſtomacke. *Vas breue arterioſum.*

The Meſentericall Arterie is double, both of them proceeding from the fore-ſide of the trunke, the vpper below the *Cæliaca*; the lower below the ſpermaticall Arteries. *Arteriæ Meſentericæ.*

The vpper [Tab.4.Fig.1. .fig.2 : Tab: 8, 10.] is propagated into the vpper part, and almoſt into the whole Meſentery, and reacheth his manifolde ſurcles to the empty gut, the *Ileon*, and a part of the Collicke gut, where it approacheth the right Kidney. Superior.

The lower [Tab.4. Fig.1.9, Tab.8,12] Meſentericall Artery, runneth vnder the lower end of the Meſentery, and eſpecially to the left ſide of the Collicke gut and the right gut, and maketh the Hemorrhoid veſſell, together with the Veins, and it is noted in the ſecond figure of this fourth Table at this marke *. And ſo much at this time ſhall ſuffice to haue ſpoken of the Gate-veine, and the Cæliacall Artery in this place, conſidering that we ſhal haue fitter occaſion to proſecute their branches heereafter. Now we will proceede vnto the guts. Inferior.

CHAP.V. *Of the Guttes.*

THe Guttes are called in Greeke ἔντερα, and *Inteſtina* in Latine, becauſe they are placed in the inmoſt part of the body, and doe take vp the moſt part of the cauity of the lower belly. [their naturall poſition appeareth in the 2.and 5. Tables,] And becauſe they farre exceed the length of the ſame, they are neceſſarily gired and rouled into manifolde Convolutions, [Tab.2,5,and 6.] that it might conteine them, as we vſe to rowle vp a rope if we would put it into a bag. They are knit together by the benefite of the *Meſenterium* [as appeareth in the 7. Table,] by which alſo, and the interpoſition of the *Omentum*, they are tied to the backe, and are held vp or ſupported by the cauities or hollowneſſe of the hanch bones. The Names. Their Connexions.

They are long bodies, and commonly ſixe times ſo long as the man whoſe entrals they are, round they are and globous, that they might bee more capacious and leſſe ſubiect to outward iniuries; Hollow, but not all of a bore as wee call it, carried alſo in circuler conuerſions (excepting their beginning [Tab.6.fig.1,2. at I and²] and their end, that the entrance and out-gate of the Aliment ſhould not bee interrupted) leaſt the nouriſhment ſhould too ſuddenly ſlip away before the *Chylus* be fully diſtributed, and conſtraine a man eft-ſoones to call for more, and ſo be the cauſe of inſatiable guloſity or rauenouſnes, which would as *Plato* ſaith, interrupt all good and liberall learning. For ſo we ſee thoſe creatures whoſe guts from the ſtomacke to the ſiedge, are either ſtreight or lax, are inſatiable deuourers, which alſo *Ariſtotle* witneſſeth in his third Booke *de partibus animal.* chap.14. for the looſeneſſe or laxneſſe of the gut encreaſeth, and the rectitude of it haſtneth the deſire of meate. Wherefore thoſe creatures whom it became to bee more moderate that way, haue more of theſe circumvolutions, which alſo make them able longer to containe the excrements, that they ſhold not be enforced but at their own pleaſure to vnburden themſelues; for thoſe creatures that continually put in, muſt haue anſwerable euacuation. Their length. The reaſons of their length. *Plato.* *Ariſtotle.*

The guts are continued with the ſtomack at the right Orifice called the *Pylorus*, but their ſubſtance is thinner then that of the ſtomack, and by reaſon of the inumerable veines that are inſerted into *Ieiunũ* and *Ileon*, which do in a ſhort time ſuck it, they receiue much nouriſhment, which preſently by as many veſſels is conueyed to the Liuer. This ſpeedy diſtribution of the nouriſhment could not be, if it went out of one ſtomacke into another, becauſe there would not be ſpace for the inſertion of ſuch a world of veines, and ſo the diſtribution muſt needs be ſlower, and beſide much of the Aliment would eſcape the Veins, vnleſſe it were eft-ſoones all the way of the paſſage againe and many times as it were reuiſed, till there were nothing left but bare excrement. The veines of the guts called Meſeraicks.

And albeit there be but one *ductus* or through-paſſage from the *pylorus* or mouth of the

ſtomack

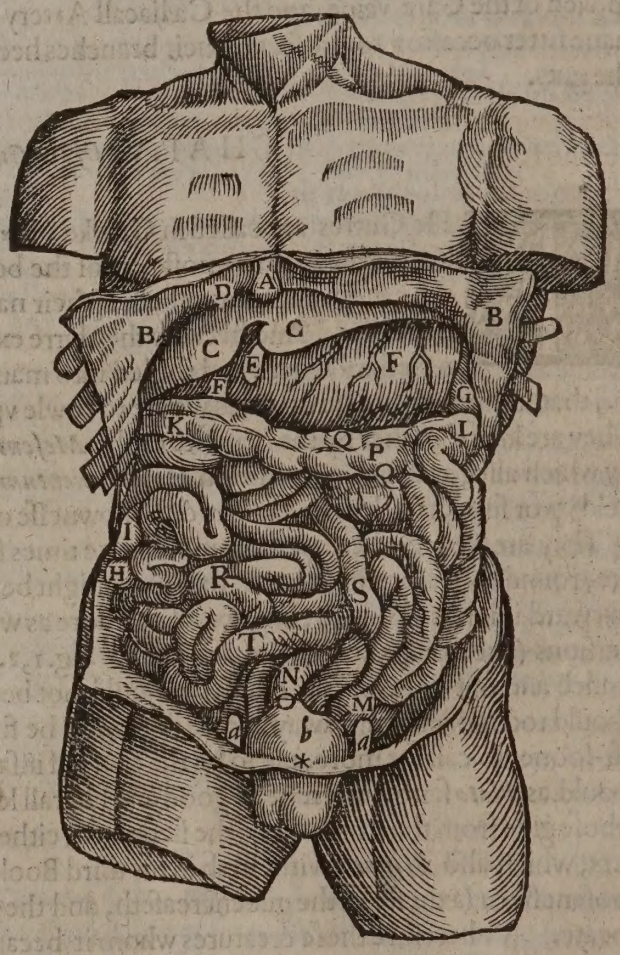
ſtomacke, euen to the ſiedge, that it may not amiſſe bee called one gut; yet becauſe the parts of it do very much differ in ſubſtance, figure, office, place, magnitude, and in number of circumvolutions and turnings: therefore firſt in reſpect of their ſubſtance, there are two ſorts of guts. One ſlender, fine, and ſmall, which *Galen* calleth μικρὰ ἔντερα, λέπτα. *Plautus* calleth them *Lactes* of the old word *Lacio*, which ſignifieth to draw, becauſe they draw the *Chylus* more powerfully then the other which are thicke and craſſe, called by *Hippocrates* τὰ κῶλα.

The ſmall guts.

The ſlender or ſmalleſt ſort of Guts is three-fold, *Duodenum*, *Ieiunum*, and *Ileon*, which though they haue all almoſt one capacitie or amplitude, yet they are eaſily diſtinguiſhed by their ſcituation, length, and by their Meſeraick veines. And beſide, the *Ieiunum* about his beginning, where it is tyed to the backe, is ſometimes obſerued to be enlarged.

Tab. 5. ſheweth the Bowels of the Lower belly, euerie one in their owne place. The ends of the lower Ribbes, together with the Midriffe and the Peritonæum adhering thereto are turned backe, that the Liuer, the Spleene, and the Stomacke might be better ſeene.

TABVLA. V



A. The Breſt blade cald *Cartilago enſiformis*.
B B. The *Peritonæum*, togither with the Midriffe and the broken ribs bent outward.
C C. The *Gibbous* or bunching part of the Liuer.
D. A Ligament tying the Liuer to the Midriffe.
E. *A* part of the vmbilicall veine.
F F. The ſtomacke filled full of meate.
G. *A* part of the Spleene.
H. The blinde gut of the late writers: for the ancients tooke the top of the Colon for it.
I. The beginning of the great or thicke guts.
I. and ſo to K. ſheweth the paſſage of the Collick gut from the right kidney to the Liuer, & ſo the Collicke and the ſtone on this ſide are in one place, and therefore hardly diſtinguiſhed.
K. to L. the ſame Collicke Gut lyeth vnder the whole bottome of the ſtomack, which is the reaſon that thoſe which are troubled with the Collick caſt ſo much.
L. to M. The paſſage of the Colon, from the ſpleene vnto the ſhare bone by the lefte kidney a-way which maketh the payne of the Stone and the Collicke on the lefte ſide, very harde to diſtinguiſh.
N. The Colon ending into the right gut.
O. The beginning of the right Gut vnto the bladder.
P. Q. The ſunken or fallen ſide of the Colon at P. and his Chambers and puffes at Q.
R S T. The leſſer Guttes, eſpecially lying vnder the Nauell.
a a. The two vmbilicall arteries.
b. The bottome of the Bladder.
* The Connexion of the bladder and the *Peritonæum*.

The great guts.

The thicke or great guts are as many [Tab. 6. fig. 2, 3.] called *Cæcum*, *Colon* & *Rectũ*, all differing in ſcite, figure, and magnitude. For the *Colon* and *Rectum*, that is, the Collick and the right guts, are more ample then all the reſt. For the figure, ſome are right as it wer by a line, as the *Duodenum* and *Rectum*, the reſt are full of turninges, and as it were chambered more or leſſe.

Their offices.

In reſpect of their offices, ſome are appointed both for the perfiting and for the diſtributing of the *Chylus*, to wit, the ſmaller and narrower, that ſo the ſmalleſt crumme of the meate may meete with their ſides and veſſels; others are appointed for baſer vſe, to gather together the excrements, as the Craſſe or thicke guts.

Their ſcituation.

The ſmaller, partly by reaſon of their excellency, partly for their commodity, do occupy the middle place, [tab. 5. R S T. tab: 7.^{cccc}] euen all the Regions of the nauell & the *Hypogaſtrium*, yet in dogs it is not ſo, which deceiued the Ancients, who called the ſmall the

vpper

vpper guts, the thicke the lower; which order we finde different in man, whoſe Colon occupies the vppermoſt place, and paſſeth vnder the bottom of all the ſtomacke. For their commodity they are placed neare the Center of the Meſenterie [tab. 7. ᴮ] that the meſentericall branch might without any great diſtance be conuayed vnto them, and ſo the *Chylus* quickly transferred to the Liuer.

The thicker guts are placed towards the ſides [table 5. table 6. figure . table 7. ᴱᴱᴱᴱ] partly becauſe they might giue way to the ſmaller; (the Colon alſo is knit to the bottome [table 5. ᴮ] of the ſtomacke) partly that like a munition or defence they might compaſſe and defend the ſmaller, leaſt they ſhould bee preſſed or ſtreightned. They were alſo made large, that they might containe the greater quantity of excrements, before they were prouoked to excretion.

The firſt of the ſlender guts [table 6. figure 1, from ᶠ to ᴷ] which *Herophilus* calleth δωδεκαδάκτυλον, in Latine *duodenum*, hath his name from the length of twelue fingers, which yet we finde it not to holde in our bodies; it may be, becauſe now a dayes the ſtature of Man is much impaired. *Galen* calles it ἔκφυσις, as it were a production, to wit of the ſtomacke, which name yet ſome doe onely allow to the *orifice* of this firſt gut. This *duodenum* beginning on the right ſide, at the *Pylorus* [table 6. figure 1, ᴴ] is reflected or turned backeward, vnder the ſtomacke, that it may bee knit with membranous ligaments, to the ſpondelles or rack-bones of the loynes, to hold it ſtraight and right downe; for if it ſhould haue beene rowled and circled about, firſt the entrance of the *Chylus* ſhould haue beene hindered, and then being gotten in, it would haue beene ſubiect to bee returned backe againe. Moreouer, it would haue beene a hinderance to the veine that commeth from the Port or Gate of the Liuer, and to the Arterie which paſſeth to the Liuer: beſide, indeede there is no ſpace or ſcope for any ſuch cõuolutions or turnings in that place. It determineth vnder the Colon, about the beginning [table 6, figure 1, ᴷ] of his windings. It is the ſtraighteſt of all, that the *Chylus* ſhould not ſuddenly and togetherward fall into it, out of the ſtomacke; and ſomewhat thicker then the other two, becauſe it receiueth a ſhort veine from the trunke of the Port veine, which we called *Inteſtinalis* [table 3, ᶻ] or the Gut veine, (but no *meſeraicall* veine at all) and an Arterie from the *Cœliacall*; both which are led along according to the longitude of this Gut, and to the beginning of the *Ieiunum*. Vnder this the *Pancreas* or ſweete bread lyeth, eſpecially in Dogges, that it may boulſter the veſſels, and moyſten or ſupple the gut with a ſlimie moyſture.

Duodenum.

His ſcituation

The *duodenum* receiueth no *meſeraical* vein

The ſecond ſmall gut is called νῆστις *Ieiunum*, or the [table 6. figure 1, ᴹ] Empty gut. It is for the moſt part found empty, and that becauſe of the innumerable meſeraicks, and thoſe very large, which ending in the inner cõate of the gut, doe there gape with open mouth, & draw away the *Chylus*, as the nouriſhment falles lower and lower, till all the goodneſſe bee drawne away. And if any part of the *Chylus* ſcape the firſt conuolution of this gut, yet the ſecond or third will embrace it, till moſt of the profitable iuyce be drawne away by the *meſeraicks* to this gut belonging; which ſuction or drawing is much encreaſed by the vicinitie of the Liuer, and beſide, the Aliment as it paſſeth by, being yet fluid, doeth eaſilie follow.

Ieiunum the empty gut.

His beginning [table 6. figure 2. ᴺ] on the right ſide vnder the Colon, where the conuolution of the Guttes begin, is very liuid or blewe; when it commeth aboue the Nauill (whoſe whoſe region it taketh vp) being before wound vp into many circled labyrinths, it endeth into the *Ileon*. It is in length twelue palmes and three fingers. In breadth it exceedeth not the little finger, vnleſſe it be puffed vp with winde. In the beginning of this *Ieiunum*, or in the end [table 6. figure 1. ᴸ] of the *duodenum*, is the paſſage of Choller or Gall inſerted, called *Porus Biliarius*; that after the *Chylus* is now fallen downe beneath it, the Liuer may vnburden it ſelfe by this vent of this humor, which by his *acrimonie* prouoketh the Guts both to expell the excrements contayned in them, and to work downward the ſlimy phlegme that cleaueth vnto them; whence it is, that in diſſections it is found more empty then the reſt.

His place.

Length.

The paſſage of the gal called *Porus Biliarius.*

Why it is found empty according to his name.

The third Gut is called λεπτὸν or *tenue*, that is ſlender, becauſe of the tenuitie of his membranes; it is called alſo εἱλεός, from a worde which ſignifieth to encompaſſe, as it were the circled gut; alſo *voluulus*, becauſe of his many circumuolutions, in which the meat maketh profitable ſtay and deliberation: this gut alſo giueth name to that fearefull diſeaſe called *Ileos*, or *Iliaca paſſio*. It is ſcituate vnder the Nauell, on both ſides at the bones called *Ilea*, or hanch bones, and the cox or hip-bone: and though it be continuall with the *Ieiunum*, and

The *Ileon* his names.

Iliaca paſſio, miſerere mei Deus, a cruel diſeaſe.

His ſcituatiõ.

and of a like ſubſtance, yet heerein it differs, that we finde it not either ſo empty of *Chylus*, or ſo full of Veines. It beginneth where the gut groweth reddiſh, and the Meſeraicke Veines grow ſmaller and fewer, and paſsing vnder the right Kidney, meeteth vvith the craſſe and large or great gut, that [Tab.6.Fig.1: O] buncheth out like a great Globe or Bowle, and endeth in his left ſide where it hath two holes; one continued with the *Ileon*, another lower, to which the blinde gut is ioyned. [Tab.^{6}, Fig.$^{1.2,3,N}$] It is the longeſt of all the guts, euen one and twenty palmes long, and as broad as a finger is thicke, and becauſe this gut onely can fall into the cod, this onely cauſeth the rupture cald *Hernia inteſtinalis*, the gut rupture, and ſo much of the ſmall guts.

The great guts.

The great guts begin [Tab.^{6}.Fig.^{1,2,3}, O] where on the right ſide they ſtrut out like a great Bowle, where there hangeth downe an Appendixe or addiament, which is the firſt of the thicke guts, and is called τυφλὸν or *Cæcum*, that is the blinde gut [Tab.^{6} Fig.^{1,2,3} P] hauing that name from his obſcure vſe, others call it *Monoculus*, becauſe it hath but one perforation, yet ſome ſay it hath two in the ſame ſuperficies, but diuided by ſo fine & thin a diſtance, that it ſeemes but one: when notwithſtanding one of them is the end of the *Ileon*, [Tab.^{6} Fig.^{1,2,3,N}] and the other the beginning of the blinde gut, or of the Appendix. It taketh his beginning which is very thicke, from two heads; the end of the Ileon, [Tab.^{6} Fig.^{1,2,3,N} &°] and the beginning of the Colon: vnleſſe we had rather ſay, that the vtmoſt part of the Colon ends into it, and that the Ileon is continued with it where it begins. In a man it is a ſlender long Appendix, and like vnto a great writhen worme [Tab.^{6} Fig.^{1,2,3,R}] or a little purſe narrow toward the bottome, whence alſo it is called *Saccus*; farre narrower and ſtreighter then any of the other guts; foure Finger long, and as broade as the thumbe, and is knit to the right Kidney by the mediation of the *Peritonæum*, but hath no Meſentery tyed vnto it. In Dogges it is farre greater, and beſides differs in the originall, for in them it taketh his beginning rather from the beginning of the Colon on the right ſide of it, then on the left.

The blind gut called *Cæcum Inteſtinum*.

What was the *Cæcum* of the Ancients.

The Ancients did not call this Appendix of the *Colon* the blind gut (whence ſome of them haue deliuered, that in Beaſts there are three thicke guts, in a man but two) but for it, did take that Globous [Tab.6.Fig:2 at O] extuberation, which paſſeth from the inſertion of the ſmall guts vnto the Colon, of which we ſpake euen now. Wherefore *Galen* placeth the blinde gut on the right ſide of the *Ileon*, but the Colon he ſaith ariſeth out of the left ſide, brought firſt vpward by the right *Ilea* or flankes. This blinde gut of the Ancients which we call the beginning of the Colon, in Apes, Dogges, Swine, & Oxen is very great, in whom it is a good helpe that in their groueling gate, when their fore-parts are violently moued, the excrements do not recoile to the ſmall guts. The vſe of this blind Gut ſaieth *Galen*, (vnderſtanding the beginning and bowled extuberation of the Colon) is to be as a belly wherein the excrements are receiued, that if in the paſſage any thing haue eſcaped the diſtributing vertue of the ſmall guts, and the Meſeraick Veynes, it might by remayning ſometime in this blinde gut be exhauſted and ſucked out. But the vſe of the Appendix is whilſt the Infant is in the wombe, to receiue thoſe many and liquid excrements which in many moneths time are gathered together. After the childe comes to any growth in the world, as we ſay, the vſe of this Appendixe ceaſeth, becauſe (proportionably conſidered) there are fewer excrements gathered in the Collicke gut, and thoſe that are, are dryer and thicker. Wherefore one ſaith verie wel, that the excrements growing fewer, are not driuen therinto, and ſo it remayneth contracted and gathered together, not in length, (for the length continueth the ſame) but in the Latitude, ouer it was in the Infant, euen we ſaide before, it hapneth in the vmbilicall veſſels.

Thevſe of the blinde gut of the Ancients.

Of the Appendix.

The Colon or Collick Gut.

The ſecond thicke gut, Tab.6.Fig:1.and 3. from ° to ². Tab.^{5} from ᵗ to °, Tab.^{7} ᵉᵉᵉ] is more lax and looſe, and is called κῶλον of a word which ſignifieth to fore-flow, becauſe by reaſon of his many blowne and ſwelling Chambers or Cels [Tab.^{6} Fig.^{2,3} ʸʸ] it forſloweth the paſſage of the excrements; or of a word which ſignifieth to wreth, or to rack, becauſe of the racking Collick paine which in it is bred. The beginning of this gut, called by the Ancients the blinde gut [Tab.^{6} Figur. ^{1,2}. O] as is ſaide, is very large and more capacious then any other part of the gut is, and round like a Bowle or Globe, ſeated in the right *Ileum* or flanke, [Tab.^{5} from I. to K.] for there is a fit place empty for it, becauſe the right kidney hangeth hie, to which it cleaueth; and touching the bladder of Gall vnder the Liuer, yea ſometimes being ſo faſtned vnto it, that it is dyed yellow by it, is turned vpward, rouled ouerthwart vnder the bottome of the ſtomacke [Tab.5.from ᵏ to ˡ] and ſo paſſeth ouer the

The ſcituation of it.

ſmall

ſmall guts. And this is the reaſon why the Ancients haue written that it occupyeth the vpper place, yet not in Dogges but in Men. And ſurely heerein Nature hath made an excellent prouiſion both for nouriſhment and concoction, becauſe we eate many hard meates, which neither the ſtomacke nor the ſmall guts are able ſufficiently to put ouer, which are deteyned in the Chambers of the Colon; and becauſe this Colon paſſeth vnder the ſtomacke, and the Liuer the fountaine of heate, are there concocted and made fit for noriſhment, and from hence are ſuckt away by the Meſeraick Veines. On the left ſide it is tyed to the Spleene [Tab.5 e] with rare and thin Membranes; from the Spleen it paſſeth vnto the ſhare bone [Tab.5 from L to M] and then is preſently turned backward to the left Kidney, to which it is ſtrongly bound: and ſo maketh a ſhew as it were of a Scythian bow. This ſtrong binding of the Collicke gut to the left Kidney, is the cauſe why the Nephritick paine or fit

Tab. vi. ſheweth the leſſer and the greater guts.

The firſt figure ſheweth the forme and folding paſſage of the leſſer guts.

The ſecond Figure ſheweth the forme and conuolutions of the greater guts, and the Muſcles of the Fundament.

The thirde Figure ſheweth together with the figure of the great guttes, the value or Membrane of the Colon *or Collicke gut.*

The fourth Figure ſheweth a part of the collick and right guts and the coats of the Guts.

TABVLA. VI.

FIG. I.

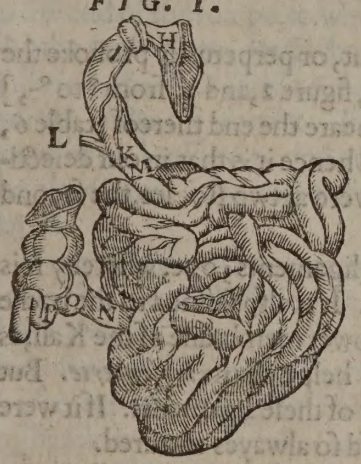


FIG. II.

FIG. III.

FIG. IV.

H. 1, The *Pylorus* tied with a part of the ſtomacke.

I K. 1. The gut cald *Duodenum.*

L 1. The pore or hole of the choler, cald *Porus Biliarius.*

M 1. The beginning of the empty gut, cald *Inteſtinum Ieiunum.*

N 1,2,3. The end of the leſſer guts.

O 1,2,3. The beginning of the great guttes, where is the blind gut of *Galen* and the *Ancients.*

✝ 3. The value or membrane of the collick gut, ſet to the ſides of the Gut on eyther hand, where his beginning is not made round, but lax.

P 1,2,3. The blinde gut of the later *Anatomiſts.*

Q R S T V. 2,3. The collick gut from O to Q from the right kidney to the liuer: from Q, to R. all along the bottome of the ſtomack: from R to S from the Spleene to the ſhare bone: from S to T the returne of the Collicke gut to the nauell: from T to V how it is led along again downward to the right gut

* 3. The Collicke gut opened, that the value may better appeare.

X X 2,3. The ſunke or flatted place of the Collicke gut.

Y Y 2,3. The chambers or cels of the Collicke gut.

Z 2,3. The beginning of the right gut.

a 2,3. the round Muſcle of the right gut.

b c 2,3. The two right Muſcles of the right gut.

d 2,3. The place wher the right gut is tied to the yard in mē & to the neck of the womb in women.

ee 4. The firſt and vtter coat.

ff 4. The 2. coate of the guts.

g 4. The third coate of the guts which maketh their body.

hh 4. A part of the Meſentery, tying the right gut to the Holy or great bone.

of

of the ſtone in the Kidneyes, is confounded with the collicke payne. But to returne to the collicke gut; at the left Kidney it is much narrower, leaſt it ſhould compreſſe the ſpleene; wherefore thoſe men that haue ſwolne ſpleenes, doe not eaſily breake winde, vnleſſe their ſpleenes be preſſed; here alſo it hath no chambers: and againe ariſing more on the left ſide as it were vnto the ſeate of the Nauell [table 6. figure 2. and 3, from ˢ to ᵀ] maketh a double, (which double is the cauſe that in this place the collicke torments are moſt grieuous, ſo that wee haue ſeene heere apoſtemations [table 5.ᴹ] maturated or ripened through the skin, and after healed) and ſo being carried to the beginning of the *os ſacrum*, in that very place where on the one ſide it aroſe from the right gut, it now on the other ſide [table 5.ᴺ] endeth in it; but is diſtinguiſhed from it by a certaine narrowneſſe, cauſed as it were by the whipping about [table 6, figure 2, from ᵀ to ᵀ] of a ſtreight band: which place all Phyſitians in the adminiſtring of Cliſters, and cure of the Collick torments, muſt not forget. The length of this Gut is about 7. palmes [demonſtrated in the 6. table & the 1, and 2, figures] and ſo many fingers, and in breadth it is as wide as a mans Fiſt is thicke.

The length of the Collick gut.

It is the largeſt and wideſt of all the Guts, that it might be a receptacle of the winds ingendered in the firſt concoction, to wit, in the ſtomacke and the ſmall Guts; as alſo of the vnprofitable and fæculent part of the *Chylus*, which remayneth about the end of the ſmall Guts: leaſt ſayth *Galen* in his fourth booke *de vſu partium* and the 18, chapter we ſhould be conſtrayned continually, or ouer often to empty our bodies, becauſe within vs there is continuall ſegregation made of the excrements from the nouriſhment. Now this Gut being ſo capacious, thoſe excrements may in great quantity bee retayned, and auoyded but at conuenient times.

The Celles alſo or chambers of this Gutte [table 5, ᵠᵠ, table 6, figure 2, 3, ʸʸ] make much for this purpoſe of Nature; and hence it is that ſome Birds whoſe Guts haue no ſuch Celles, doe continually mute, or very often: and therefore ſome haue called this collicke Gut, *The lower Belly*.

Leaſt therefore the excrements ſhould forceably iſſue out, or perpetually prouoke the expulſiue faculty, this Gut firſt of all ariſeth vpward [table 6, figure 2, and 3, from ° to ᵠ,] afterward bending downward, it is againe reflected vpward neare the end thereof [table 6, figure 2, and 3, from ˢ to ᵀ] not vnlike to a Romaine S. And hence it is that in our deiections, the excrements are not auoyded all at once, but as it were at two ſtooles, the ſecond following the firſt, after a little diſtance of time.

And becauſe it is very great, therefore it hath two ſtrong ligaments; one, whereby it is faſt tyed to the vpper parts, and ſo by the other to the lower. It is alſo faſtned to the backe by meanes of an externall membrane, ſpringing out of the lower membrane of the Kall, as the other Guts are tyed to the backe by the interpoſition or helpe of the *meſenterie*. But in Dogges it is no where tyed to the Kall, neither hath it any of theſe ligaments. If it were narrow as the ſmall Guts, it would alwayes be diſtended, and ſo alwayes tortured.

Againe, whereas the excrements when they paſſe out of the *Ileon* into the Collick gut, doe manifeſtly aſcend [table 6. figure 3. from ᴺ to °] leaſt in the compreſsion of the belly, (which is made by the muſcles of the *Abdomen*, and the helpe of the midriffe) to the ſiedge; the excrements and putrid or rotten vapours ſhould not ſo eaſily finde the lower paſſage by the right gut, as returne out of the Colon into the *Ileon*, and ſo diſturbe the diſtribution of the *Chylus*, and at length iſſue by the mouth as it hapneth in that miſerable diſeaſe called *Iliaca paſsio*, where the gut *Ileon* doubling into it ſelfe, maketh ſuch a conſtipation of the belly, that the meat cannot deſcend, and ſo the remainders thereof being yet liquid in the ſmall gut, and defiled with the noyſome ſauour of that place are returned by vomit, and at laſt the excrements themſelues, though not out of the great guts; leaſt I ſay in euery notable compreſsion of the belly this ſhould happen, Nature hath ordained & ſcituated a certain value, leaf-doore, or floud-gate, at the beginning [ta. 6. fig. 3. *] of this Colon where it is ioyned to the *Ileon*, which is membranous and thick, and looketh vpward, becauſe the excrements of the meate are carried by aſcent not by deſcent, out of the Ileon into the Colon, as is ſaid before. This value is eaſily found by the Anatomiſt, if you poure water into the right gut and hold it & the Colon vpward, for then you ſhall perceiue that none of the water will paſſe into the Ileon, no nor winde, vnleſſe you preſſe it very hard. You may finde it alſo when the guts are cleanſed, but then it is ſomewhat vitiated by the transfuſion of water, which you muſt neceſſarily vſe in the cleanſing of them.

The values of the Colon.

Hence it is that *Galen* ſayth, the matter of cliſters cannot naturally aſcend into the Ileon

Lib. 5. method. meden. cap. 6.

or

or ſmall guts, although their medicinable force and vertue may goe a great deale higher. *Andreas Laurentius* hath deſcribed this value in his Anatomie, where alſo he maketh mẽtion of *Bauhines* deſcription of it, and attributeth vnto it this vſe eſpecially of hindering the regurgitation of the excrements. But *Archangelus* ſayeth, that at the blinde gut there are three values like thoſe in the heart, all appoynted for the ſame purpoſe, which the reſt before did agree vpon. *Lib. 13. method. medend. cap. 17*

The ſubſtance of the Colon is more fleſhy then that of the other guts, and beſide it hath many Celles [table 5. ⁹⁹, table 6. figure 2, 3, ʸʸ] or chambered cauities, diuerſly as it were arched; and againe ſinking into a narrower extent, wherein the hardeſt part of the meate may reſt, and ſo receiue (for they lie vnder the ſtomacke and the Liuer [table 5. at ᶜᶜ) a better concoction. But the ſmall guts haue none of theſe Cels; the reaſon is, that the excrements of the Chylus ſhould not be reteined therein, the diſtribution of the Chylus hindered, or the place of the belly taken vp therewith.

Finally, leaſt the Cels or chambers of this Colon ſhould bee diſſolued or looſened foorth, there runneth through his middle and vpper part after his length, a certaine *vinculum* or band of the breadth of the middle finger: which being looſened or broken, thoſe chãbers are diſſolued. When this colon comes near to the right gut, it becommeth round [table 6. figure 2, 3, ᵛ] like the Colon in Dogges (that ſo the excrements and the winde alſo which iſſueth ſometimes ſilently, ſometimes with noyſe, might bee more eaſily excluded) and ſo his end is narrow and ſtraight, fit to ioyne with the right gut.

The third of the great guts [table 5, his beginning is at ° vnder the bottom of the bladder, table 6. figure 2, 3, ᶻ, table 7, ᶠᴳ] is called *rectum*, of his right bore, and ἀρχὸν, the *beginner* by *Hippocrates* in his firſt booke *Epidem*: becauſe it hath his beginning where the boughts of the guts do end, and thence paſſeth from the top of the *ſacrum* or holy-bone, to the end of the rumpe, to which it is firmely tied by the interpoſition of [table 6. figure 4. ʰʰ] the *Peritonæum*, leaſt when it is burdened, it ſhould fall with his owne waight: and ſo endeth in the ſeate, [table 6. figure 2, 3, ᵃ] in men vnder [table 6, vnder ᵇ] the bladder; in women vnder the wombe. In this place it is very great, which *Hippocrates* calleth *Partem laxam* or his looſe part, and groweth to the yarde of men [table 6, figure 2, 3, ᵈ ſheweth the place] and to the necke of womens wombes, by the interpoſition of a muſculous ſubſtance. The laſt great gut called *rectum*, or the right gut.

Hence comes in men that notable ſympathy of this gut with the bladder, which maketh a man that is troubled with the ſtone in the bladder, to be euery moment prouoked to the ſtoole; but yet in women there is a greater ſimpathy betweene this gut and the wombe; ſo that oftentimes by compaſsion the gutte is vlcerated, and the excrements are auoyded by the ſecret parts. This gut could not be more commodiouſly placed, for the excremẽts being herein by degrees collected, may be fitly together excluded. To the end of this gut a round muskle [table 6. figure 2, 3, ᵃ] is annexed, which may binde the *orifice* of it, whereupon it is called by *Hippocrates* and *Galen* σφίγκτηρ, that the excrements might not at al times but onely by voluntary compreſsion and violence be euacuated. This gut is a palme and a halfe long [table 6. figure 2, 3, from ᶻ to ᵃ] and three fingers broade, and very corpulent or ſubſtantiall, and hath certaine fat appendixes or additaments growing to it without. The great ſympathy betweene the right gut and the bladder. The ſphinter muſcle.

All theſe Guts as they are ſimilar parts, do conſiſt of a ſpermaticall ſubſtance and bloudy matter, changed into their proper fleſh, if it may be ſo called: but as they are diſsimilar they haue a membranous ſubſtance, that ſo they may without paine be diſtended or ſtretched, when they ſtrut with the *Chylus*, with the excrements, or with winde; yet is not this membranous ſubſtance alike thicke, but the ſmall guts haue it more ſlender, the great guts more craſſe and thicke. This may bee ſliuen into three coates; whereof one is common [table 6. figure 4, ᶜᶜ] to them all, as hauing his originall *mediately* ſayeth *Galen* 4. *vſu partium* 17, from the *Peritonæum*: but immediately the *duodenum* and that part of the Colon that cleaueth to the ſtomacke, hath it from the lower membrane of the Kall, although it be not ſo in Dogs: and the *Ieiunum*, the *Ileon*, and the remaynder beſide of all the great Guts, haue their coate from the membranes of the *meſenterie*. For the membranes of the *meſenterie*, carrying the veſſelles to the Guts, doe grow vnto them, where parting aſunder, they ſeuerally walk along the ſides of the Guts, & do degenerate into their third coat. This firſt cõmon coat they haue as inſtead of a ligament, ſo as a couering for their better defẽce. They haue beſide, ². proper coats, [tab. 6. fig. 4. ᶠᶠ ᴮ] partly that their expelling power ſayth *Galen*, might bee of greater force, partly alſo for ſecurity, when they abide many difficult The 3. coates of the guts.

4. *vſu part.* 17. aſſayes in diuers diſeaſes, eſpecially in the *Dyſenteria* or bloudy Flux, that the inmoſt beeing hurt, the other may remaine perfect for the performance of their duty. Wherefore, many haue beene knowne to ſuperuiue when the inner coate hath beene eaten out: yet both theſe coats are thinner and ſofter then thoſe of the ſtomacke, becauſe this receyueth the meate when it is harder and vnconcocted, thoſe when it is for the moſt part concocted and attenuated or made as thin as pulpe. The firſt [Tab. 6. fig: 4, ff] or vtter of theſe coates is membranous, but ſtrong; for the moſt part furniſhed with tranverſe Fibres, ſprinkled alſo with fleſhy fibres, firſt to encreaſe his heate, that thereby the leſſe laboured and digeſted parts of the Chylus may in their paſſage be more throughly concocted; and again, that like Muſcles they might contract the guts to expel thoſe ſmal remainders which could not be auoyded by the compreſsion of the *Abdomen*. Ouer this coate is drawne as it were a Veyle or Filme, thight but very fine, wouen for the moſt part of right Fibres. The other proper [Tab. 6 Figure 4 g] coate is on the inſide in the ſmall gats rugous or plightie, (in the Colon the plights are vnfoulded and ſpred abroad into Cels) that it might moderately ſtay the Chylus as it falleth downward, that if any part of it bee leſſe laboured, it might receiue a farther degree of concoction in the paſſage.

Moreouer, that the ſame Chylus might the better bee ſucked vp by the Veynes, theſe tranuerſe foulds make this coate longer, and in ſome doubly and trebly longer then the vtter coate; and for this cauſe alſo it was neceſſarily gathered into Plights; and theſe foulds or ſurphles are moueable, & may be driuen out of one place into another, as the ſurphles of a hemme gathered vpon a thred, that they may reteine the Chylus moderately & without violence. This coate is alſo neruous, but yet it appears more fleſhy, becauſe of a cruſt like a Membrane which compaſſeth it about, engendred of the proper excrements of the guts ariſing from the third concoction, leaſt the mouth of the Meſeraicke Veins opening into this inner coate, ſhould be ſtopped; and leaſt the ſame inner coate, or the mouths of the Veines ſhould be made callous or hard by the perpetuall paſsing of the Chylus. Both theſe proper coats at the end of the Colon, and in the right gut are thicker and thighter or faſter.

The cruſt of the guts whiche is firſt loſt in bloody fluxes.

They haue Fibres of all kindes, the inner oblique or ſlope Fibres, that it might reteine the middle tranſuerſe or ouerthwart that it might expell; to the outward are added a few right Fibres, leaſt the tranſuerſe ſhould be ſeparated aſunder: wherefore without the gut they are tyed together with the right fibres as it were with a ligament, euen as Chirurgions for the holding on of circular or round Ties, do caſt ouer them right bands. But the right Fibres are fewer in the ſmall guts, more in the great. In the Colon the Fibres follow his impreſsions or chambers. They are very great and large in the right gut, becauſe of the many and hard excrements there heaped together.

What fibres euerie coate haue.

The veſſels of the guts [exhibited in the third Table] are Veines from the port veyne, arteries from the Cœliacall [Tab. 4] and Meſentericall branches. For to the *Duodenum* & the beginning of the *Ieiunum*, the gut-veine called *Inteſtinalis* runneth with a long courſe; but the reſt of the *Ieiunum* and the *Ileon*, and a part of the Colon, from the *Ileon* to the left kidney, haue Meſeraicke [Tab. 4. Fig: 2 ooo] veyns, which are carryed from aboue with an oblique paſſage through both the coates of the Meſentery, as it were out of his center. The vſe of their veines, is to carry the Chylus from the guts to the Liuer, and bring back blood to them for their nouriſhment; of their Arteries, that they might be cheriſhed with vitall blood, and by their perpetuall motion be preſerued from corruption and putrifaction. *Galen* thought, that they tooke vp alſo a little of the meate in their paſſage. To the other and remaining part of the Colon, and to the right gut, they are in a right line carried from the left Meſentericall Veine, and the inferiour Meſentericall Artery.

4. The veſſels of the guts.

4. *vſu part.* 17.

They haue Nerues from the ſixt paire, the *Duodenum* very ſmall ones from thoſe ſtomacke ſinnewes which compaſſe the *Pylorus* or lower mouth of the ſtomacke: the reſt of the guts on both ſides, receiue infinite ſurcles from a braunch which proceedeth from the roots of the ribs, from whence they haue moſt acute ſenſe, that they might apprehend the prouocation of the choller and the excrements; notwithſtanding that a certaine mucous or ſlimy matter which lineth them within, makes their ſenſation ſomewhat more dull.

The vſe of the fat and ſlime in the guts.

On the outſide they are ſmeared, ſometimes couered with fat, and on the inſide lined with ſlime, and as it were nealed like earthen pots, that through their ſlipperineſſe the excrements of the belly might ſooner be precipitated or thruſt downe (ſome thinke the Colon is lined within with fat) and leaſt their exquiſite ſenſe ſhould bee continually prouoked.

The

The common vſe of the guts is to be inſtead of earth or the ſoile to yeelde nouriſhment to the parts. For as in the earth is contained the Aliment of the plants which they draw out by the Fibres or ſtrings of the roots, ſo in the guts is the Chylus, which the rootes of the Meſeraick Veines do ſucke out for the nouriſhment of the creature. Againe, the vſe of the ſmall guts is to be the Inſtrument of diſtributing the Aliment; ſo ſaith *Galen* in his fourth Booke *de Vſu partium*, the 8. and the eighteenth chapters. For it behooued that there ſhould be one Organ to concoct, and another to diſtribute; for otherwiſe the veines could not but haue drawne crude together with concocted and laboured nouriſhment. For the Chylus boyled in the ſtomacke, was to bee diſtributed to other partes, and the profitable parts thereof to be ſegregated and ſeparated, which is accompliſhed by the Meſeraicall veines. But becauſe, as it hapneth in a Viall full of water, if it bee turned vp, the water cannot yſſue at the necke but by drops and degrees; ſo in the guts, if the Veines had beene ſet to one place, the multitude of the Chylus would haue ſtopped his owne paſſage: therefore Nature hath well prouided, that the guts ſhold be drawn out into a great length, that ſo in each part of them a litle quantity might be conteyned, & ſo a conuenient proportion ſuckt away by the mouths of the Veynes. Moreouer, in the very paſſage of the Chylus along the guts, it receyueth a farther degree of concoction, as alſo doth the blood in all the Veines. And therfore the ſubſtance of the guts is not much vnlike that of the ſtomack. But becauſe they are not ſo neere the heate of the Liuer as is the ſtomacke, therefore Nature hath aſſiſted theyr cold membranous ſubſtance, by couering them with the warme happing of the *Omentum* or Kell, whereby their weake heate is cheriſhed.

The common vſe of the guts

The vſe of the ſmall Guts.

The vſe of the great guts is to contain the thicke excrements and remainders of the meat together with the choler deriued vnto them from the Liuer by the paſſage of gall, as alſo the winds that are daily gathered, which are ſtored in the chambers of the *Colon*, and the bredth of the other great guttes, and kept in by the Muſcles of the fundament, as we ſhall more manifeſtly ſhew afterward.

The vſe of the great Guts.

CHAP. VI. *Of the Meſentery.*

IT is called *Meſenterium* and μεσέντερον in Greek, becauſe it is placed in the middle of the guts, which as we ſaid before, are called ἔντερα: for it is placed in the middeſt betweene the guts toward their backward poſition [Tab:7 Fig.1.] and incircleth them round. It is called alſo μεσάραιον from his peculiar ſubſtance. His figure is circular [Tab.7.Fig.1,2] and plaine, but gathered into folds; about the beginning it is narrow, in the middle ample and large, and in the ſides, eſpecially the left ſide where it deſcendeth to the right Gut it becommeth more long, for which cauſes *Galen* ſayde, it was treble or three-fold.

The ſcituation cauſe of the name.

His Figure.

His beginning is at the firſt and thirde Spondell or racke bone of the Loynes from the *Peritonæum*, from whence are produced membranous Fibres which ſpend themſelues in the two Membranes [Tab.7. Fig.2 ᵀʸ] of the Meſenterie, from whence it is that there is great conſent betweene the Loynes and the guts; beſide there paſſe alſo from thence certaine Nerues vnto the Meſentery. For it is compounded of Membranes, Nerues, Veines, Arteries, Glandules and Fat.

Originall.

It hath two Membranes [Tab.7. Fig,2, ᵀʸ] one lying vpon another (in Dogs where it admitteth no veſſels, they ſo grow together, as if it were but of one ſimple Membrane, neyther hath it any fat to make ſeparation) and thoſe firme & ſtrong, as well for the ſtrengthening of the veſſels which are manifold and paſſe together vnto the guts, to which Veſſels it ſerueth for a band and ſtrong muniment, as alſo leaſt in violent motions the poſition of the guts ſnould be altered or confounded, and that they might be ſtronglier tyed to the backe.

His Membranes.

The Meſeraicke Veines [Tab.3. ddd Tab.7. Fig: 2] diffuſed or ſpred abroad thorough theſe Membranes are innumerable and wondrous ſmal, as it were the fine & ſlender threds of the roots of a tree, which are ſtill gathered into greater, till they growe all into one entire roote; ſo theſe veſſels by little and little are knit together into greater, and thoſe greater into others yet greater, till they are all vnited into one veine, which paſſeth vnto the Port, and reſteth in the hollow ſide of the Liuer. Two Arteries called the vpper and lower *Meſentericall*, are ſent vnto the guts, which make the Meſeraicke Arteries, which alſo run through the Meſentery, that by their continuall motion they might ventilate, and with

¶ *The first Figure sheweth where the Mesentery beginneth or ariseth, his scite, connexion, and vesselles; in it also the guts are remooued from the middle of the Belly, and are laide vpwarde and downward vnto the sides, that the Mesentery might better appeare.*

The second Figure sheweth the Mesentery taken and freed from the body.

TABVLA. VII.

FIG. I.

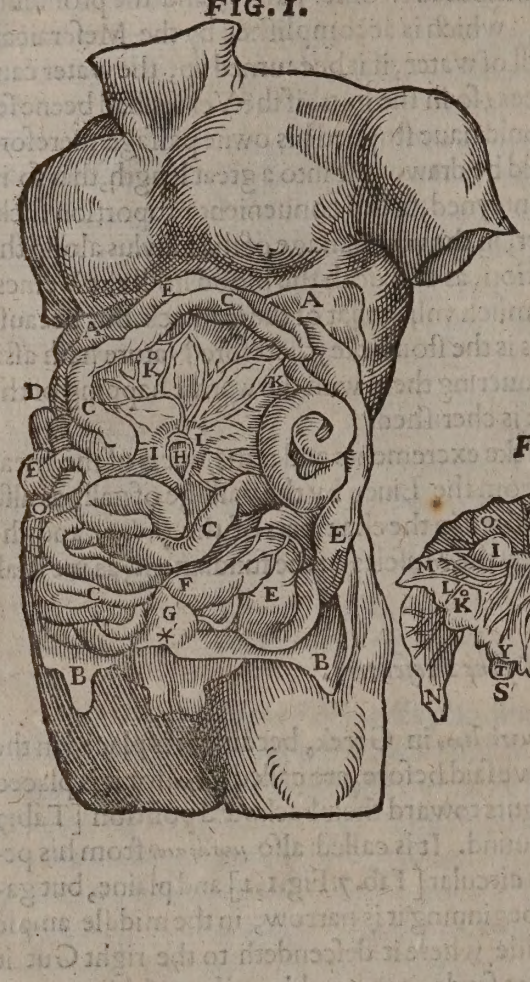


FIG. II.

AA BB. Parts of the *Peritonæum* or rim of the belly, turned outward, and laide vppon the Ribs which are broken backward.

C C C C. The lesser guts.

D. The blinde Gut.

EEEE. The Collicke gut, compassing round about the Lesser guts.

F. The beginning of the right Gut.

G. The bladder.

* The place where the *Peritonæum* or rim groweth vnto the Bladder.

H 1,2. The Center of the Mesentery where the *Peritonæum* tyeth the great Artery and the Hollow Veine to the racke-bones of the backe.

I I 1 2. A glandulous bodie set for security vnder the distribution of the vessels which are inserted into the Center.

KK 1,2. Glandules set between the distributions of the vessels which passe to the guts.

L M M M 2. Do circumscribe that part of the Mesenterie which tyeth the small guts to the backe.

From N. to O. 2. A portion of the Mesentery which ioyneth the right part of the Colon to the backe.

From O to P 2. The Membrane of the lower kal, tying that part of the Colon that is knit to the stomacke, to the backe.

From P to Q 2. A part of the Mesentery knitting the left part of the Collicke gut which runneth from the spleen, to the right gut

From Q to R. A part of the Mesentery tying the right guts to the backe.

S 2. The two Membranes of the Mesentery parted asunder with the nayles.

T The first Membrane of the Mesenterie.

Y. The other Membrane of the Mesenterie.

Lib.6. Admin. Anat.Cap.6. vitall spirite illustrate the Mesenterie and guts, and so keepe them from corrupting; all which also are ioyned into one great one which lyeth vpon the backe. This *Galen* obserued sometimes to be presently parted in twaine out of one roote, sometimes to be two seuerall distinct instantly from their beginning.

Nerues. It hath Nerues also sprinkled diuersly as it were into many tendrils. Those are two, one on eyther side frō the nerues which are reached from the sixt paire to the roots of the ribs: which Nerues being spread abroad after the fashion of a Membrane, doe inuest the branches of the Arteries, by which meanes the colde Nerues by the touch and society of the Arteries becomming warme, the Animal vertue proceeding from the Brain, is more freely communicated to the guts. It hath Nerues also from the sinnewes proceeding from the Spondels of the loynes, and that for his better sense, that feeling those things that molest it, the expelling vertue being prouoked, it might turne them downe into the Guts. These nerues together with the Veines and Arteries, are receiued into the center [Tab.7.Fig:1, 2 H] of the Mesentery, diffused through the whole body of it, and with an innumerable offspring are carried through his coates or Membranes vnto the guts. It hath also glandules

The *Glandules* of the Mesentery. or kernels very [Tab.7.Fig:1,2 KK] many (to which certaine thredy or hairy veines do come from the Meseraickes) interlaced with infinite diuarications of the braunches of the Port-veine, & the great Artery, with which they hold a certain proportion for their magnitude; but the biggest of them are about his center, where the first distribution of the vesselles is made, and where they are most gathered together: as wel that they may support & diuide the vessels, as also that they may hinder their compression which would otherwise forslow

the

the diſtribution of the *Chylus*, like as they doe when they become *ſcirrus* [table 7, figure 1. 2, II] or hard; whence followeth for this reaſon a generall conſumption of the whole body.

Beſide, it had not beene ſafe that ſo many veſſels riding ſo high, being ſo ſlender and running ſo long a courſe from their originall, ſhould bee carried to the trunke of the port-veine without a kinde of convoy; wherefore theſe glandules or kernels, as it were certaine wedges, are ſet between their diuiſions, that in vehement motions they be not broken nor offende one againſt another. Finally they ſerue to moyſten the guts, that their concoction may be celebrated by elixation or boyling, that is, by heate and moyſture.

Amongſt theſe glandules there is plenty of Fat, made of bloud ſweating or falling out of thoſe veſſelles wee ſpake of euen now, and there retayned by the ſolidity of the membranes, with which fat the middle ſpaces are filled, and the heate of the parts cheriſhed, that ſo the Chylus which is carried through them, may be prepared for ſanguification. The fat of the meſentery.

And although this *Meſenterie* be one and continued together, yet in regard of his double originall, and of the guts which it tyeth together, and of the two Arteries; it may be diuided into that *Meſenterie* which knitteth together the ſmall guts [table 7, figure 2, I MM] in the middeſt of the belly called μεσάραιον; and into that which tyeth the colon [table 7, fig. 2, frõ N to °] both on the right ſide and the left; [tab 7, figure 2, from P to Q] not vnder the bottom of the ſtomack, for to that it is knit by the help of the *Omentum* [table 7. figure 2, from ° to P] & in his lower part [tab 7, fig 2, from Q to R] groweth to the right Gut, & is called by *Hippocrates* μεσόκωλον. Laſtly, it hath a part which they call the appendixe [table 7. fig. 2, from Q to R] of the *Meſenterie*, being of the nature of a ligament, whereupon *Galen* diuideth it into the right, the left, and the middle. How *meſeraion* differeth from *meſocolon*

The vſe of the *Meſenterie* is to tie the Guts together, as it were by a common ligament, and to faſten them to the Racke-bones of the Loynes, that they neither ſhould bee confuſedly ſhufled together, or fall downe by reaſon of their waight. But the Colon or collick Gut in that part of it that runneth vnder the ſtomacke, is tyed to the backe by the Kell as hath beene ſayde. Againe, the double membrane of this *meſenterie* doth incloſe and ſuſtaine the veſſels which runne through it, that they ſhould not be medled together, and ſo hinder one another, as alſo that they might more ſafely attaine vnto the Guttes, whereas happely if they were not ſtrengthned by this duplication, they might break when a man did leape or fall, or otherwiſe ſtraine his body there about. The vſe of the *meſentery*.

Of the Pancreas or ſweet-bread. CHAP. VII.

Pancreas, that is, all fleſh, is ſo called becauſe of the likeneſſe it hath with fleſh in an ordinary and moderate body, for in a Fat body it ſeemeth to be Fat it ſelfe: it is alſo called παλλίκρεας. It is an vnſhapely body, very looſe, all glandulous (wherefore *Archangelus* would haue it called *Pandenon*) and large. It hath his beginning at the firſt ſpondle of the loynes, and thence defuſed, ſpreds it ſelfe vnder the backpart of the ſtomack and his bottome, the *duodenum* [as appeareth in the table belonging to the chapter of the bladder of gall at the note '] and the gate-veine at the Kidneyes, euen as farre as the ſeates of the Liuer and the ſpleene. In Man it is not ſo red as in Dogges, and in all beaſts becauſe of their groueling gate, it lyeth vppon the ſtomacke. The ſweet-bread. The ſituation of it.

That which in his middle appeareth white, is his *Parenchyma* or proper fleſh, and becauſe of his whitenes and ſoftneſſe, ſome call it *Lactes*: we call it the ſweet-bread, becauſe in Swine it is eſteemed a ſweete morſell, though the ſweet bread of a Calfe or Veale bee another thing, as you ſhall heare hereafter. It hath veines but very ſmall from the Gate-veines for his nouriſhment: and Arteries from the *Cœliacall* for his life; ſinewes alſo from the ſixt paire, and glandules. The eſpeciall vſe of it is to ſuſtaine, ſecure, and preſerue from Compreſsion the diuiſions of the branches of the Gate-veine, of the *Cœliacal* Arterie, and of the nerues which are carried to the ſtomacke, and to the Gut called *duodenum*; but eſpecially the Splenick braunch which paſſeth vnto the ſpleene; as alſo the veſſell which contayneth the choller called *Porus Biliarius*, becauſe about his ſeate is the originall of all their diuiſions. His veſſels & glandules. His vſe.

Moreouer another vſe it hath, by reaſon of the many glandules in it contayned, which is to licke vp the remaynders of that muddy and ſuperfluous Fat (or if you will, the crude The vſe of his *Glandules*.

and phlegmaticke part of the bloud, which *Hippocrates* calleth *Cœnosam humiditatem*, the muddy moysture) which the Kall and Mesenterie could not containe: that the bloud being thus depured, might bee exhibited to the inward partes, more pure and better defecated.

Againe, whereas these glandules doe as it were feede vppon and deuoure the crude or raw and moyst part of the bloud; it must needes follow that from them should exhale infinite vapours moyst and hot, which steaming vp round about the stomacke, doe make this action of *Chilification*, a kinde of elixation or stewing, like a Maryes Bath.

Another vse of the *pancreas*

Finally, the *Pancreas* like a pillow or quishion is placed vnder the stomacke and other parts, least being filled, they should leane too hard vpon the spondelles of the loynes, and be violated with their hardnesse. Albeit *Fallopius* and *Archangelus* I know doe reiect this vse of it, becausse there is no such vse of it in brute beastes, in whome it lyeth aboue the stomacke. It parteth also the stomacke from the great Arterie, least when the stomacke is very full and strutteth out, the Arterie should be pressed, and so the free course of the vitall spirits to the lower parts intercepted.

Of the branches of the Hollow Veine, and the great Arterie, disseminated through the lower Belly. CHAP. VIII.

WEE should now proceede vnto the stomacke, sauing that wee thinke it not amisse before wee come vnto it, to giue you a short view of the diuarications of the hollow veine and the great artery, as they diuide and subdiuide themselues in the lower belly; that if you please in the same body, you may call for a sight of them before you trouble the carcasse too much, by remooving the stomack and other entrals. And first of the braneches of the Hollow veine.

The Hollow veine hath two trunkes, one passeth vpward through the midriffe, the other downward, which we will diuide into the trunke and the branches. From the trunk [table 8. ^{s}] most commonly there proceed on each side foure veines.

Adiposa. The first is called *Adiposa*, or the veine of the Fat of the Kidneyes: the left of these, [tab. 8 ^{g}] is for the most part higher then the right [table 8. ^{f}.] They runne vnto the Fat of the Kidneyes and their vtter membrane. Sometimes one of them ariseth from the Emulgent, as appeareth, [table 8 ^{f}] sometimes both.

Emulgent. The second is the Emulgent; the left of these [tab. 8. ^{e}] which sometimes ariseth threefould, is higher then the right [table 8. ^{d}] least one of them should hinder another in their suction; and longer also, becausse the seminarie or seede vessell springeth out of it [table 8. ^{i}.] Both of them when they attayne vnto the middest of the body of the Kidneyes are diuided and so implanted to carry vnto them the whey of the bloud, which becausse it should not returne againe into the hollow veine, Nature hath placed certaine values in the emulgents.

Spermatica. The third is called *Spermatica* or the seede veine; the right of these [table 8. ^{h}] is sometimes double, arising out of the middle of the trunke below the Emulgent: The left ariseth from the Emulgent [tab. 8. ^{i}] becausse otherwise it must haue rid ouer the Artery, yet notwithstanding sometimes it receiueth a small branch from the *Caua* or hollow veine. They descend obliquely to the testicles, and determine in the Bodden body called *Corpus varicosum*, to which they carry the matter of the seede.

Lumbares. The fourth are called *Lumbares* or the veines of the Loynes. These are sometimes two, sometimes three of a side [tab. 8. ^{mmmm}] they passe between foure rack-bones of the loynes, and doe send two veines to the sides of the marrow of the back which arise vnto the Brain, and haply they bring from the braine a part of the matter of the seede.

Rami Iliaci. Afterward at the fourth spondell of the loynes, the trunke of the hollow veine [table 8. ^{n}] is diuided into two branches which are called *Rami Iliaci*, out of which before their diuision there proceede on either side two veines.

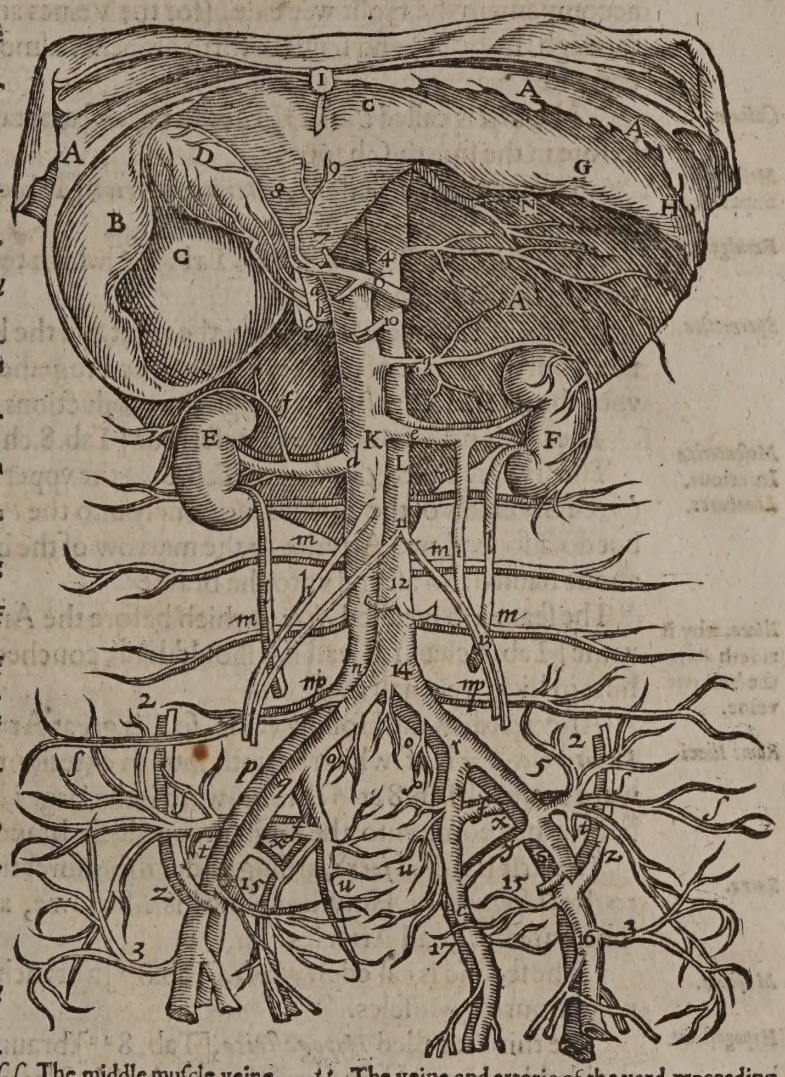
Musculæ. The first is called *Muscu'a* [table 8. ^{nP}, ^{nP}] one of which is higher then the other; sometimes it proceedeth not from the branches, but from the trunke, and passeth to the muscles of the loynes and of the *abdomen* or paunch, from whence it hath his name.

Sacra. The second is called *sacra*, a small veine, sometimes single, sometimes double, and passeth through the vppermost and formost holes of the *os sacrum* or holy-bone [table 8. ° °] vnto his marrow, and hath his name from the bone.

Then

The Branches of the Hollow veine and the Great Arterie, disseminated through the lower Belly.

TABVLA VIII.



AAA The midriffe called *septum transuersum.*
B G The Gibbous part of the liuer, the right side at *B.* the left at *G.*
C C The hollow part of the Liuer called *Cana iecoris.*
D The bladder of gall.
EE The foreside of both the Kidneyes.
H The Ligament which tieth the liuer to the midriffe.
I The vmbilical or Nauel-veine where it is inserted into the Liuer.
K The trunk of the hollow veine called *vena cauaL*
L The trunke of the great arterie.
N The gullet where it passeth through the midriffe or the bosom of the Liuer called *sinus hepatis*
a The trunke of the Gate-veine.
b The *cysticke* veines where they goe to the bladder of gall.
c The passage of the bladder of gall which goeth to the gut called *duodenum.*
de The emulgent veines with the emulgent arteries vnder them.
f The right fatty veine called *adiposa dextra*, arising out of the emulgent.
g The left fatty veine arising out of the trunke of the hollow veine.
h i The spermatical veines, the right arising out of the hollow veine, the left out of the left emulgẽt.
l l The two vreters which carry the vrine vnto the bladder.
mmmm The veines and arteries of the Loynes called *Lumbares.*
npnp Below, the vpper muscle veine and arterie, called *musculæ superiores.*
n The diuision of the hollow veine aboue the holy bone.
o o The holy veines and arteries called *sacræ.*
p The *Iliacal* branch of the hollow veine.
q The *Iliacal* arterie.
r The diuision of the *Iliacal* attery, and the *Iliacal* veine vnder it, into the inward & the outward: the inward is marked with *p* the outward with *s.*
ff The interior transuerse or crosse braunch. *ssss* The middle muscle veine. *tt* The veine and arterie of the yard, proceeding from the branch marked with *p* and *s.* *uu* The *Hypogastricke* veine which sendeth branches from the inner bough to the bladder, the wombe, and almost al the parts in the watercourse. *xx* The place where the vmbilical arteries are inserted. *y* A portion of the external branch, wherewith the internal is augmented. *z* Character. The remainder of the inward branch. 2,2 The *Epigastrick* vein which is a propagation of the vtter bough: it creepeth vpward by the lower parts of the *Abdomen* to the Nauel. 3 The lower muscle veine, reaching to the *Coxendix* or Hips: a veine without an arterie, which deriueth his branches to the muscle of the fundament, and to the skin about them. 4 The great arterie piercing the midriffe. 5 The artery of the midriffe called *Arteria phrenica.* 6 The *Cœliacal* artery. 7 9 An artery passing to the Liuer. 8 The *Cysticke* artery, or artery of the bladder of gal. 10 The vpper *mesenteri-acall* artery. 11. The original of the spermatical arteries. 12 The lower mesentericall artery. 13 The conjunction of the spermatick veine and artery. 14 The diuision of the great artery into the *Iliacal* branches, and how it ascendeth aboue the hollow vein 15 The artery of the priuities called *arteria pudenda*, which is a shoot of the inmost braunch, going to the parts of generation. 16. 17 The remaynder of both the trunks marked with *p* and *s*, running to the thighes.

Then the *Iliacall* branch is on both sides bifurcated or forked [table 8. vnder *r*] into an exterior or vtter [table 8. vnder *q*] and an interior or inner. From these proceede three veines. *The bifurcation of the Iliacall veines.*

The first is called *Epigastrica* [table 8. vnder character, *t*] which is disseminated into the *Peritonæum* and the muscles of the *abdomen.* The chiefe branch of this veine ariseth vnder the right muscles of the *Abdomen*, euen vnto the vein called *mãmaria*, and with it about the Nauell is ioyned by *Anastomosis* or *inocculation.* *Epigastrica.*

The second is called *Hypogastrica*, a notable veine [table 8, *uu*] and sometimes double. It is disseminated almost into all parts of the *Hypogastrium* or watercourse, the bladder the yarde, and the wombe; and at the right gut maketh the external *Hæmorroidall* veines. *Hypogastrica.*

The third is called *Pudenda* [table 8. character *15 15*] which is consumed into the *scrotum* and the flesh of the yarde or *virile* member. *Pudenda.*

These veines being thus deriued out of the *Iliacall* braunches of the hollow veine, they passe on either side out of the lower belly [table 8, *s t*] & are called *Crurales*, or the veines of the thighes, of which we shall speeake hereafter. And thus much of the Branches of the Hollow veine, now followeth the great Artery. *Crurales.*

The

The greater trunke of the great Artery.

The Great Artery also hath two Trunkes, the lesser goeth vpward, the greater [Tab.8. character 4] descendeth, because it hath more parts to be communicated vnto. This trunk accompanieth the Hollow Veine (for the Veines and Arteries are sorted together quite through the body) and sendeth forth branches almost like vnto it, of which wee will now entreate.

Cœliaca.

The first is called *Cœliaca* [Tab.8.char.6.] a notable Artery of which wee haue spoken before in the fourth Chapter.

Mesenterica Superiour.

The second is called *Mesenterica superior* [Table 8. character 10] before chapt.4. described.

Emulgens.

The third is called *Emulgens* [Tab.8 d e] which together with the Emulgent Veines enter into the Kidneyes.

Spermatica.

The fourth is called *Spermatica*, the right and the left [Tab.8.char.11] both of them arise from the trunke of the great Artery, and together with the Spermaticall veines attaine vnto the Testicles, passing through the productions of the *Peritonæum* or rim of the belly.

Mesenterica Inferiour.

The fift is called *Mesenterica* inferiour [Tab.8.char.12] described in the 4.chapter.

Lumbares.

The sixt are called *Lumbares*. [Tab.8. at the vpper mmmm] They passe through the holes of the Spondels of the Loynes, not onely into the *Peritonæum* and the Muscles confining, but do also send two Arteries to the marrow of the backe, which together with the veynes aboue named, do ascend vnto the braine.

Iliaca, why it rideth aboue the hollowe veine.

The seauenth is called *Iliaca*, which before the Artery is diuided, rideth ouer the hollow veine [Tab.8.char.14] least if it should haue couched vpon the bone, it might haue beene hurt in his perpetuall motion.

Rami Iliaci.

Afterward, as the Hollow veine, so this great Artery is diuided into two trunkes, called *Rami Iliaci*, each of which parteth into an exteriour or outward, and an interiour or inward branch; [Tab.8 at q q] the outward is the larger, & runneth into the thigh. From these before they come vnto the thigh proceede six branches.

Sacræ.

The first is called *sacræ*, arising vnder the bifurcation or forking, [Tab 8 oo] and passeth to the *Os sacrum* or Holy bone and his Marrowe, as the Veines did called before *Sacræ*. These are but small Arteries.

Musculæ.

The second is called *Musculæ*, [Tab:8 ff] a branch of the vtter bough running vnto the neighbouring Muscles.

Hypogastrica.

The third is called *Hypogastrica*, [Tab, 8 uu] braunches of the inner bough passing vnto the bladder, the yard, the wombe and the Muscles which couer the share bone.

Arteriæ vmbilicales.

The fourth are called *Arteriæ vmbilicalis*, of which we haue spoke abundantly before.

Epigastrica.

The fifte is called *Epigastrica* [Tab.8 char.1] a branch of the inner bough, which climbeth vp vnto the right Muscles of the *Abdomen*, and is ioyned with the *Mammaria*, as is saide of the Veines.

Pudenda.

The sixt and last is called *pudenda*, [Tab.8 char.15.] a braunch of the vtter bough, which is consumed in the skin of the virile member. That which remaineth of the great Arterie,

Crurales arteriæ

passeth into the Thigh, and is called *Cruralis* of which wee shall entreate afterward: now we will returne vnto the Entrails or Bowels, from which we haue a little digressed, to shew you the diuarications of these vessels in the Lower belly, but that very breefely, because we reserue their more exact description to their proper place in the Booke of the Veynes and Arteries.

CHAP. IX. *Of the Stomacke.*

The stomacks names.

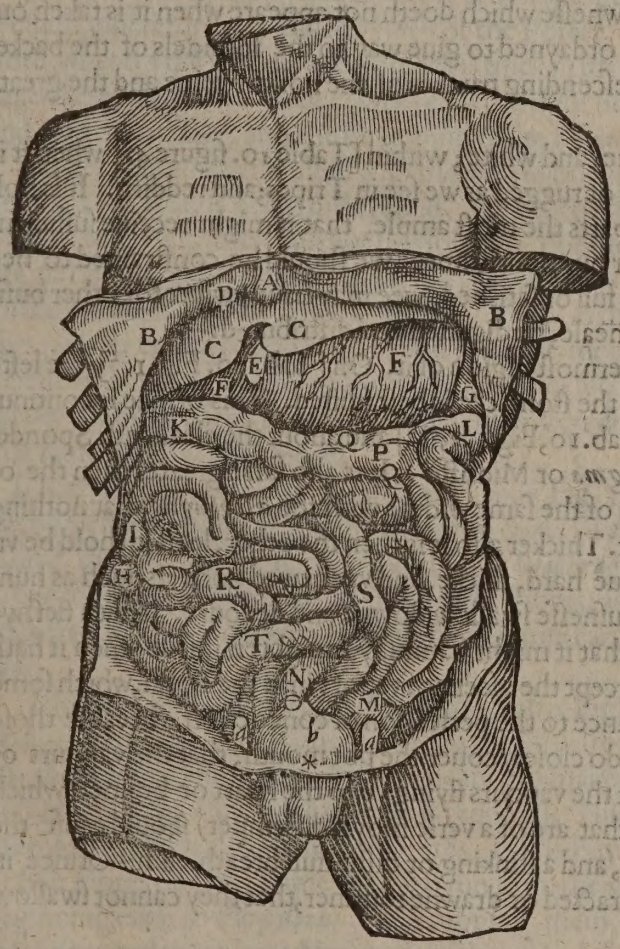
THE Ventricle as it were a little Venter, is called in Greeke κοιλία, that is, a cauity or hollownesse, of a word that signifieth Hollow or *concauous*, and γαστὴρ, which is indeede the proper Greeke word for it. It is the common receptacle of meate and drinke, the Kitchin of the body. It is but one in men and other creatures that haue both iawes set with Teeth, but in those that chew the cud, which haue but one iaw of teeth, it is four-fold; in Birds it is threefold. It was necessarily to be placed where his extention might not be hindred, yet as neere the mouth as might be for the receyuing of the meat to be coqued for the whol body. Wherfore, for that there was no roome in the chest or neere the mouth, it beeing taken vp by the parts which serue for respiration, and encompassed beside with a wall of bone, which would haue hindred his dilatation, it is seated in the lower, [Tab. 9. ff] immediatly vnder the

The scituatiō.

the *Diaphragma*, betweene the Liuer and the Spleene, [Table 9 cc. ſheweth the Liuer, G. the Spleene, and FF the ſtomacke] in the middeſt of the body, ſaith *Galen* 4. *vſu partium* 7. eſpecially his vpper orifice, ouerthwart between the two *Hypochondria*, that it might be continuated with the guts, not ſo much for the diſtribution of the *Chylus*, as that the Excrements might be more eaſily ſetled lower, leaſt with their noyſome vapors they ſhould moleſt the heart and the Brain. It lyeth for the moſt part of it, in the left *Hypochondrium*, as appeareth in the 9 Table, becauſe heere it had moſt roome, and againe for the more commodious implantation of the vpper mouth, by which it receiueth the meate. Moreouer, to giue way vnto the [Tab:9, cc] Liuer which takes vp the right ſide; and laſtly, with the Spleene to helpe to ballance the body againſt the Liuer. Before, it lyeth bare, eſpeciallie when it ſtrutteth, not vnproperly then called ἀπόζομος γαστὴρ *venter fermentatus*, (for when it is empty, it is more hid vnder the Liuer) that it may eaſily be felt with the hand; wherfore

Tab. 9. ſheweth the Bowels of the Lower belly, euerie one in their owne place. The ends of the lower Ribs, together with the Midriffe and the Peritonæum adhering thereto are turned back, that the Liuer, the Spleene, and the ſtomacke might be better ſeene.

TABVLA.IX



CC. The *Gibbous* or bunching part of the Liuer.

FF. The ſtomacke filled full of meate.

G. A part of the Spleene.

H. The blinde gut of the late writers: for the ancients tooke the top of the Colon for it.

K. to L. the ſame Collicke Gut lyeth vnder the whole bottome of the ſtomacke, which is the reaſon that thoſe which are troubled with the Collick caſt ſo much.

L. to M. The paſſage of the Colon, from the ſpleene vnto the ſhare bone by the left kidney a-way, which maketh the payne of the Stone and the Collicke on the lefte ſide, very harde to diſtinguiſh.

P. The ſunken or fallen ſide of the Colon at P. and his Chambers and puffes at Q.

it is quickly affected with cold, and therefore care muſt be taken of it. On the right ſide, the vpper and forepart of it lyeth vnder the hollowneſſe [Table 9. F vnder C] of the Liuer, and by it is embraced, whereby his heate is cheriſhed. On the left ſide his greateſt part reacheth to the *Diaphragma*, wherupon when it is too much ſtuffed, by hindering the motion of the *Diaphragma*, it cauſeth the diſeaſe calleth *Dyſpnœa*: likewiſe the Spleene, [Tab. 9 c] lieth vnder his left ſide againſt the backe and lower part thereof. Behind it are, the backbone as a ſtrong and thicke defence, and the Muſcles of the Loynes as a ſoft bed with fat growing thereto for his better repoſe, which alſo doe adde warmth vnto it. Below, it confineth vpon the guts, and the *Omentum* or Kall, and vnder his bottome lyeth the Colon [Tab. 9. KL] with the *Omentum* betweene them, whence commeth their mutuall conſent and ſympathy not onely in the Collicke paine, but alſo after the taking of a Medicine there followeth a kinde of loathing and vomiting, the excrements going this way to the *Rectum* or ſtreight gut.

His

His magnitude

His magnitude is diuers, *Hippocrates* counts it fiue palmes bigge. Taken out and blowne it is much greater then it can be whilst it is in the body; notwithstanding, whether it containe more or lesse, yet it so closely embraceth that it receyueth for the better concocting and boyling of it, that it leaueth no emptinesse in his whole cauity.

The connexiõ

But least being filled it should fall downe with the waight, his left orifice which is continuated with the [Tab.10.Fig:1,2 ^{o}] *æsophagus* or Gullet is tyed to the *Diaphragma*, the right is ioyned [Tab.10.Fig:1,2^{N} with^{P}] to the *Duodenum*. On his backe and vpper part, he lyeth vpon the backe bone, and cleaueth to the fifte spondell of the Loynes; below to the *Omentum*, other where it is loose and free, that it might more freely be distended. Finally, vnder his bottome, and especially vnder his lower mouth called *Pylorus* [Tab.10 Fig:2 ^{NP}] and vnder the beginning of the *duodenum* is the *Pancræas* placed [Table 10. figure 2.^{s}] to

The Figure.

boulster them vp. His figure [table 10.] is round for the more capacity, and that it might be lesse subiect to be offended. Long it is becausse of his two *orificies*, which make it very like vnto a Bag-pipe. On the left side, and in the bottome [Table 10. figure 2.^{M}] it is larger and rounder, but toward the right hand it is by little and little attenuated or lessened, that it might giue place to the Liuer, and that the meate might by degrees fall from that side toward the bottome, which is the chiefe place of concoction. Foreward it is [Table 10. figure 1.^{LL}] equally bunched; backeward [Table 10. figure 2.^{MNO}] whilst it is yet in the body it hath two protuberations or bunches, the left is the greater, the right is the lesse and flatter, betwixt which is a hollownesse which doeth not appeare when it is taken out and blowne; which hollownesse was ordayned to giue way to the spondels of the backe, [Table 10. figure 2,^{o}] and to the descending trunkes of the hollow veine and the greate Arterie.

His Cauitie.

On the outside it is smooth, plaine, and white; within [Table 10. figure 4.] when it is knit or gathered together, it is rugous or rugged as we see in Tripes; and reddish. It is hollow, and his hollownesse of all other parts the most ample, that it might receiue sufficient quantity of meate and drinke, least for our nourishment we should be constrained to bee alwayes eating; now, when it is once full or satisfied, wee may haue leysure for other businesse, whilst all the meate taken at a meale, be digested and distributed.

His Orificies.

There are two Orificies in the vppermost region of it. On [Tab. 10. Fig 1.^{L}] the lefte side one which appeareth best when the stomacke is best stuffed. This orifice is continuated with the *æsophagus* or Gullet, [Tab.10,Fig.1,2,^{ABC}] and about the eleauenth Spondel of the breast, is knit vnto the *Diaphragma* or Midriffe. It is also farre greater then the o-

The vpper & left Orifice.

ther, [Tab.10. Fig: 4^{l} in respect of^{m}] of the same widthe with the *æsophagus*, that nothing which we can swallow might stay at it. Thicker also it is then the other, least it should be violated when it is constrained to receyue hard, thicke, and vnchewed gobbets, such as hunger bitten folke do with great rauenousnesse swallow downe and deuoure. It hath fleshye and circular Fibres [Tab.10.Fig.4^{l}] that it might naturally streighten it selfe when it hath receiued the meate and drink, to intercept the ascent of vapors into the Brain, which some also would haue to giue great furtherance to the perfection of concoction, becausse those that would sodainly boyle any thing, do closely couer the pot mouth, that the vapours or fumes might be kept in. Againe, least the vapours flying vp to the heart or braine (which happeneth to great eaters, and those that are of a verie moyst distemper) should causse the

A pretty note why in great griefe meat wil not down.

Giddinesse, the Meigrame, suffusion, and a stinking or distastfull breath. This Orifice in some vpon extreame greefe is so contracted or drawne togither, that they cannot swallow any whole meate.

The seat of appetite.

Finally, these Fibres serue to this good purpose, that those things which we eat, should not returne into the *æsophagus* or mouth when a man stoopeth low forward, or lyeth much backward.

This Orifice becausse of the aboundance of sinnewes [Tab. 10 Fig. 1, 2. ^{TVC} Fig: 2^{XY}] that it receyueth is of most exquisite sense, that it might feele it owne want; which sense of want stirreth vp the appetite, that the creature might addresse himselfe to prouide for more meate and drinke to satisfie it. The Auncients call this Orifice καρδία, that is, the heart, becausse when it is affected, by reason of his exquisite sense, the like symptoms or ac-

καρδιαλγία or the heart-burning.

cidents follow, which follow them whose very hearts are affected, whence the pain of this mouth of the stomacke is called *Cardialgia*, we call it heart-burning, when indeed it is only a disease of the mouth of the stomacke. Sometimes the like soundings do follow as when the heart is affected; and to say truth, the heart is alwayes with it drawn into consent, not

so

ſo much becauſe of the neere neighbour-hood that is betweene them, as becauſe their ſinewes proceede from the ſame branch. Some call it the mouth of the ſtomack, commonly the vpper orifice; ſometimes it is called the ſtomack, becauſe of his largeneſſe; and becauſe it commeth nearer to the back-bone then to the breſt-blade, therefore wee applie in his diſeaſes, locall medicines both behinde and before; before is more vſuall, but when the whole ſtomacke laboureth, then we apply onely before.

The neather and the right orifice [Tab. 19. fig. 1,2 [n]] of the ſtomacke, is alſo bent a litle vpward, being the bredth as it were of foure fingers diſtant from the bottome, leaſt the weight of the meate ſhould open it. This within, beſide tranſuerſe Fibres, is compaſſed with a thicke and compacted circle, after the faſhion of a round Muſcle, or like the Sphincter or Muſcle of the ſiedge, which ſometime becommeth *ſchirrhus* or hard; and by which after a naturall inſtinct, it may be ſhut and opened; ſtreightned or widened. This remayneth faſt locked till the meate bee perfectly chaunged and boyled into a moyſt and liquid Creame, wherefore alſo it is narrower [Tab. x. Fig. 4. compare [l] with [m]] then the left orifice, yet it may be opened as wide, as do teſtifie the ſtones of fruite being eaten, Bullets of Lead ſwallowed, and other things by chaunce gotten downe, which without annoyance are againe rendred at the ſiedge. This afterward beeing by degrees relaxed and opened, doth by his ſtrength, not being prouoked by weight, driue downe the Chylus into the *duodenum* [Tab. x. Fig: 1,2. [p]] and ſo to the reſt of the guttes, to be ſucked by the Meſeraicke Veines; wherefore it is called πυλωρὸς or the Porter, commonly the neather orifice. In a word, wher on the left ſide the ſtomack is thick in his top, there his vpper mouth beginneth from the *æſophagus* or Gullet; where on the right ſide it is thicke and eleuated, there is the end of the ſtomacke, and the beginning of the *Duodenum*.

The neather and right orifice called *Pylorus*.

The voluntary work of the *Pylorus*.

But becauſe when it is filled with meate and drinke, it might bee commodiouſly diſtended, and the vyands being diſtributed, againe conſtringed and ſtreightned, and in great Meales when it is thruſt full not be violated. For theſe reaſons I ſay, the ſubſtance of it is Membranous and Neruous, which when the ſtomacke is corrugated or crumpled vp, is thicke; when it is dilated, it is thin. And verily in thoſe that are much giuen to their panches, it is ſo enlarged and rarified that it can no more be corrugated, which oftentimes is a cauſe of long weakneſſe of the ſtomacke, after ſuch gourmandizing fyts; for in whomeſoeuer the body of the ſtomacke is thin, ſuch men do worſe concoct their meat, then they that haue it fleſhy and thicke.

The ſubſtance of the ſtomack.

The Membranes of the ſtomacke.

It hath three Membranes or coates [Tab. x Fig. 3.] one common, and two proper. The fyrſt which is the vtmoſt and the common coate [Tab. x. Fig. 3. [hhh]] from the *Peritonæum*; yſſued thence where it compaſſeth the *Diaphragma* at the vpper mouth: this addeth ſtrength to the proper coats. It hath right Fibres, and is the thickeſt of all the coats which come from the *Peritonæum*, becauſe from it muſt ariſe the vpper Membrane of the *Omentum*.

The common Membrane.

The ſecond coate is altogether fleſhy [Tab. x Fig. 3 [i]] conſiſting of fleſhy Fibres, which being contracted, whatſoeuer is offenſiue to the ſtomacke, is as it were wittingly vomited vp; thoſe Fibres alſo encreaſing the heate, do make much for the helping of concoction; becauſe for that office a great heate is required. This is immediately knit vnto that which followeth: it hath alſo tranſuerſe Fibres [Tab. x Fig: 3 [i]] vnder which a few fleſhy oblique or ſide Fibres do lye. Some of which run from the vpper mouth, where they haue theyr beginning euen to the *pylorus*, but more of them do deſcend to the bottome of the ſtomacke toward the *pylorus*. Vnder theſe about the left mouth, do ariſe circular fleſhy Fibres which do ſhut the orifice: but when the tranſuerſe and oblique do moderately drawe the ſtomacke together, it embraceth the meate; if violently or ſtrongly, they driue the meate now digeſted by degrees toward the *pylorus*, becauſe it looketh vpward, and the Chylus is heauie.

The 2. Coate

The third coate is inmoſt and Neruous [Tab. x. Fig: 3 [k]] into which the veſſelles themſelues are ended: this is continuated to the coate of the *æſophagus*, and of all the Particles vvhich are in the mouth; becauſe the mouth ſhold admit of nothing that might be vnpleaſant or diſtaſtfull to the ſtomacke; and becauſe the preparation to the firſt concoction is made in the mouth. Hence it commeth, that vvhen any chollericke humor or vapour is raiſed vp, the tongue is defiled vvith bitterneſſe and yellovvneſſe, and oftentimes the exulcerations of the mouth and the tongue are communicated to the *æſophagus*, and the ſtomacke, and theyrs againe to them: by reaſon of vvhich conſent, vve cannot euacuate the head

The 3. coate.

The fibres of the third coat

head by the Palate, but we muſt alſo euacuate or empty the ſtomacke.

The vſe of the Fibres.

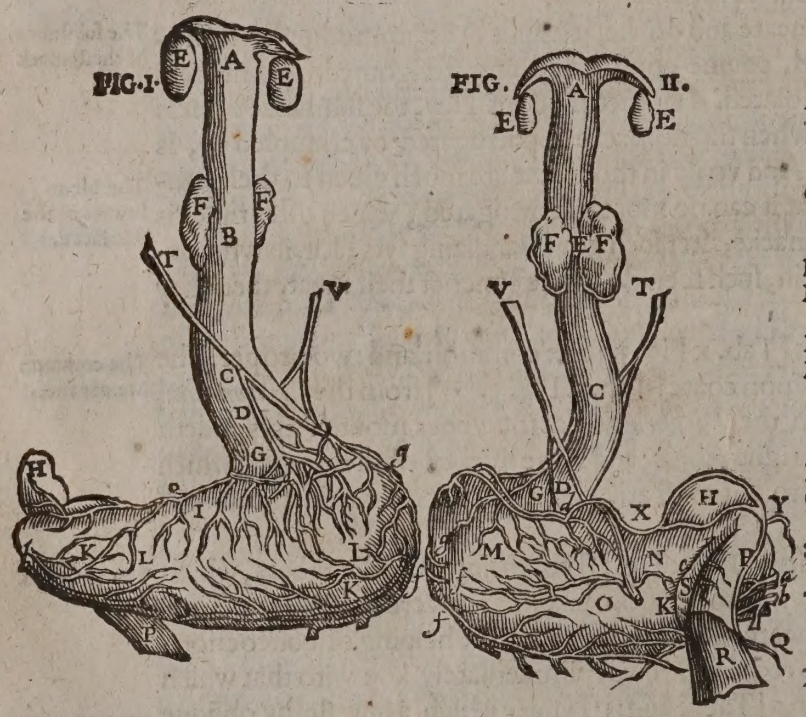
His third coat is wouen with three kinds of Fibres, that ſo the ſtomacke might bee the better extended. The right Fibres are very many and conſpicuous aboue the reſt, by which as it were by hands, they ſay it ſnatcheth his meate; by the oblique which are outwarde, it reteyneth it; and by the tranſuerſe it expelleth it after it is labored and concocted. Al theſe are ſo thightly wouen one within another, that they wil not appeare vnleſſe they be diſtracted and rent or ſliuen aſunder. This coate is alſo rugous and vnequall. In thoſe beaſts that chew the cud, harſh beſide and rough, and diſtinguiſhed into certaine proportionable inequalities, not vnlike to the hony-combe.

It hath theſe foulds and roughneſſe from a fleſhy cruſt which ariſeth out of the excrements of the third concoction of the ſtomacke, and ſerueth to defend it from anie harde thing that ſhould be receyued into it, leaſt if it ſelfe were made callous, the mouths of the Veynes ſhould be ſtopped, that neyther the Chylus could be ſucked out of the ſtomacke, nor the ſtomacke be able to draw blood for his nouriſhment. It maketh alſo ſomewhat for the moderate retention of the meate; for by his corrugation and harſhnes, it doth ſo much

Table x. ſheweth the ſtomacke with the Gullet.

The firſt Figure the foreſide of them both, with the veſſels inſerted into them. The ſecond figure their backe ſides. The thirde Figure ſheweth the Coats and Fibres of the ſtomacke. The fourth Figure ſheweth the ſtomacke with the inſide turned outward.

TABVLAX



A 1,2. The Orifice of the Gullet cut from the throate.

B 1. The ſtraight and direct courſe of the gullet from A to B.

C 1,2. How the Gullet aboue the firſt rack bone of the Cheſt from B to C inclineth vnto the right hand in the firſt Figure, and to the left in the ſecond.

D 1,2. His inclination to the left hande from C to D in the firſt Figure; but in the ſeconde to the right hand.

EE 1,2. The two Glandules called *Tonſilæ*, or the Almonds ſet cloſe to the gullet in the very end of the throat

F 1,2. Another glandulous body in the midſt of the gullet about the 5. rackbone, but it lyeth vnder it. In Calues we cal this the ſweet bred.

G 1,2. The connexion of the gullet with the ſtomack where the vpper orifice of the ſtomack is faſhioned.

H 1,2. The 2. orifice of the ſtomack, cald *Pylorus*.

I, K 1,2. The vpper part of the ſtomacke, at I the lower K.

LL 1. The foreſide of the ſtomacke.

MNO 2. The backſide of the ſtomacke and M ſheweth the prominence of the left ſide, N of the Right, but O ſheweth the doke or impreſſion, where it reſteth vpon the racke-bones.

P 1,2 The gut cald *Duodenum*.

QR 2. The paſſage of the bladder of Gall into the *Duodenum* at R.

S 2. A Glandulous body growing vnder the *duodenum*, bearing vp his veſſels.

TV 1,2. The right and the left Nerues of the ſixt paire, encompaſsing about the gullet and the vppermoſt or left orifice of the ſtomacke.

XY 2. A Nerue on the left ſide creeping vp to the top of the ſtomacke, and ſo running out to the Liuer.

a 2. The firſt Veine of the ſtomacke, cald *gaſtrica dextra*, or the right ſtomack vein comming from the trunke of the gate veine, and his Artery commeth from the trunk of the *Cœliacall* Artery, both of them reach vnto the *pylorus*.

b 1,2. The ſecond veine called *Gaſtroepiploica dextra*, togither with the Artery accompanying it, and a Nerue, all tending to the right ſide of the bottome of the ſtomacke.

c 2. The third Veine of the ſtomacke called *Gaſtrica minor*, it wanteth an Artery for his companion from the ſplenick branch.

ddd 1,2. The fourth veine cald *Coronaria ſtomachica*, with his artery, compaſsing the left mouth of the ſtomack. This is a branch of *Gaſtrica maior*. *e* 1 Certain branches from the branch marked with a diſcending from the top of the ſtomach, and running with their Artery toward the *Pylorus*. *f* 1,2. The firſt veine called *Gaſtrica maior*, deriued from the Splenick branch, which together with his arterie and nerues creepeth to the left ſide of the bottome of the ſtomacke. *g* 1,2. Veſſels deriued from thoſe which paſſe to the Spleene. *bbb* 3. The firſt and outmoſt coate of the ſtomacke from the *Peritonæum* *i* 3. The ſecond coate. *k* 1. The firſt and inmoſt parted in this place from the two other. *l* 4. A round ſwelling of the left orifice bending inward, where the Gullet is continued with the ſtomacke. *m* 4. A round ſwelling of the right orifice or the circle of the *pylorus*. *n* 4. The inward ſuperficies or furface of the ſtomack.

that

that nothing raw or vndigeſted can fall out of it. This Cruſt is ſpongie, hauing ſmal holes as it were ſhort Fibres from the inward to the outwarde ſuperficies, that by theſe hollowe paſſages of his the thinner part of the Chylus might pierce and bee ſucked away by the Veines. This cruſt may be ſeparated from the Membrane or coate in bruit Beaſts, yea alſo in the ſtomacke of a man if it be perboyled. The cruſt of the ſtomacke.

The ſtomacke is not thicker or fleſhier in the bottome then in other parts, as it is at eyther of the mouthes. Some ſay that in corpulent men there cleaueth a Fat to the bottom, on the left ſide; which when it is plentifull, they ſay a man may endure long before he ſhal haue any appetite to his meate.

The veſſelles the ſtomacke hath are theſe. Sixe veines branched from the gate-veine, ſome of which come from his trunk, others from the meſentericall or ſpleenicall boughes. From the trunke commeth the right *Gaſtricke* [table 10. figure 2.[a]] which goeth to the right *orifice*; and the right *Gaſtra epiplois* [table 10. figure 1.2.[b]] from the meſentericall bowe attaineth to the middle of his bottome. From the ſpleene bow the leſſer *Gaſtricke* [table 10. figure 2.[c]] which goeth to his back-part; the greater [table 10. figure 1. 2.[f]] *Gaſtrick*, from which comes the crowne veine of the ſtomacke, which in [table 10. figure 1,2.[d d d]] manner of a crowne incompaſſeth his left *orifice* or vpper mouth: the left *Gaſtra epiplois* diſſeminated into the other middle part of his bottome. And finally, that we call *vas breue* or the ſhort veſſell [table 10, figure 1,2.[g]] of all which we haue intreated more particularly in the chapter of the gate or port veine. The veſſels of the ſtomacke: Veines.

The office of theſe veines is to bring in bloud for nouriſhment, for it is nouriſhed continually, as it was in the mothers wombe, that is, with bloud not with Chylus, by which we grant it is delighted and refreſhed but cannot graunt that it is nouriſhed with it. Some few of theſe alſo while the Chylus is boyling in the ſtomack, doe inſenſibly ſucke out ſome ſmall part of it (for they are but few in reſpect of thoſe which determine into the Guts, becauſe in the ſtomacke is celebrated concoction, but the guts containe the Chylus already concocted, which it was fit ſhould be withall expedition diſtributed) and do change it into bloud by a naturall inſtinct, before it come to the Liuer, as *Galen* teacheth. Haply that the membranes of the ſtomacke may with it be nouriſhed. Or if thou hadſt rather, ſay that theſe veines doe carry the Chylus, they haue ſucked after the manner of the *meſeraickes*, to the rootes of the port veine, that are diſſeminated through the Liuer, that there it may be turned into bloud. From theſe veines come thoſe ſodaine refections of the ſpirits by ſweete and ſtrong Wine, Broths, and Cordials; which refections would not ſo ſoone follow, vnleſſe the Liuer did ſuck nouriſhment by them out of the ſtomacke. That which is called the *vas breue* or ſhort veine, which from the veines of the ſpleene is by an vnited paſſage of many braunches carried into his bottome, doeth there belch out a ſowre and ſharpe bloud, ſometimes to the vpper mouth to ſtirre vp appetite, (which yet properly is prouoked by ſence of want) and to ſtrengthen it by his adſtringent vertue. Their office. *Gal. 4. vſu part. 12.* A good note of the ſudden refections which come from wine & cordiall potions.

It hath Arteries from the Cœliacall branch of the *Aorta* [table 10. figure 1,2.[a b d f]] or great Artery, which doe accompany euery one of the veines, excepting the leſſe *Gaſtricke* [table 10. figure 2.[c]] to affoord ſtrength of life to preſerue it from putrifaction, by ventilation to cheriſh, refreſh and increaſe his naturall heate with their heat and vitall ſpirit, that ſo concoction might be made more perfect: but of theſe branches more hath beene ſayed in the chapter of the Cœliacall Arteries. The Arteries of the ſtomack.

It hath very conſpicuous and notable nerues from the ſixt paire, which at his *orificies* or mouths are double [tab. 10. figure 1, 2.[r r]] diſſeminated from thoſe branches which make the *recurrent* nerues, and yeilde certaine Tendrilles to the lungs and the *pericardium*, or purſe of the heart; which Tendrils becauſe of their ſoftneſſe and the length of their way, are couered ouer with ſtrong membranes and doe run croſſe one another, that for greater ſecurity they might paſſe obliquely or ſide-long; and piercing through the *diaphragma* or midriffe are on both ſides doubly diuided: ſo that the left compaſſeth the [table 10. fig. 1,2.[r r x x]] right and backe part of the mouth of the ſtomacke, and the right the lefte and forepart; which *orifice* they doe ſo inuolue, that it ſeemeth to bee made altogether of ſinewes; from the aboundance of which it hath moſt exquiſite ſence to ſtirre vp and awake the ſence of the want of nouriſhment, which ſence ariſeth from ſuction; for there is the ſeat of the appetite; & to this onely part hath nature giuen the ſence of want or of Animal hunger; for euen we feele that part eſpecially to be contracted when wee are extreamely hungry. For if we ſhould not feele a kinde of móleſtation vpon the vtter and abſolute exſucti- The nerues. The cauſe of hunger. The ſeat of appetite.

on of our nouriſhment till there be a ſupply made, wee ſhould by degrees be extinguiſhed & affamiſhed before wee were aware; for our ſubſtance is in perpetual waſting and decay; the inbred heate continually feeding vppon the Radicall moyſture. But now it is otherwiſe, becauſe the naturall hunger that is ſetled in euery particular part, hath with it adioyned a ſence of diſcontent, which is onely appeaſed by aſsimulation of freſh nouriſhment.

The appetite of euery particular part.

Theſe branches of Nerues going downeward, make his membranes which were onely membranous before, to become neruous, being diſſeminated euen to his bottome. Theſe doe alſo impart the nouriſhing force or faculty to the fleſhy Fibres of the ſtomacke. From the left nerue there runneth a branch along the vppermoſt ſeate of the ſtomacke to the *pylorus*, which when it hath foulded with a few ſmall ſurcles, it goeth thence to the hollow of the Liuer. To the bottome of the ſtomacke doe other two nerues attaine from the ſixt paire alſo, to wit, from the propagation led by the roots of the ribbes. Sometime to the left ſide there are offered nerues ariſing from the ſinewes which runne vnto the ſpleene.

Why the brain being ſtroken the parient caſts.

Wherefore ſeeing the ſtomack hath obtayned ſo many ſinewes, it is no wonder if when the braine bee ſtroken or affected, the ſtomacke alſo bee diſturbed, and vomitings cauſed, eſpecially in the *Hemicrania* or Meigrame. And on the other ſide when the ſtomacke is affected, then the Animall facultie languiſheth, and melancholly ſymptoms do happen: ſo that one of them ſuffering the other hath euer a compaſsion, not as moſt men haue of others miſeries, but indeede a reall fellow feeling.

Veſſels from the bladder of gal to the bottom of the ſtomacke.

Furthermore, there attaineth to this bottome of the ſtomacke, ſometimes a veſſell or entrance of many veſſelles from the bladder of Gall, carrying choller thither, and cauſing perpetuall caſting. A Family of ſuch men are ſayd to be at *Spire* in *Germany*, all of which family euery third day, vomit vp a good quantity of Choller, & they be called πικροχόλοι ἄνω, that is, caſters of choller vpward.

The vſe of the ſtomacke.

The vſe of the ſtomacke is to receiue meate chewed with the teeth, and drinke altered in the mouth through the gullet, and the ſame to retaine till it haue contracted it ſelfe, and embraced them by cloſing both his *orificies*; and then his naturall inbredde facultie and proper heate, boyleth and conuerteth the better part of the Aliments into white creame, which we call Chylus; That is, a ſubſtance diſpoſed to be conuerted into bloud. For the proper action of the ſtomacke, ſayth *Galen* 5. *vſu partium* 4. is concoction, it being the organ or inſtrument of the firſt concoction, or the ſhop and forge of Chilification.

Galen.

What parts aſſiſt the ſtomacks concoction.

Moreouer, becauſe the ſubſtance of the ſtomacke is membranous, and therefore not ſo hot, his ingenit heate is encreaſed, yea doubled by the adiacent parts; as the Liuer, the Midriffe, the Spleene, the Kell, the Collicke gut, the trunkes of the hollow Veine and the great Arterie, the Sweet-bread; but eſpecially the *Cœliacall* Artery, compaſsing it about almoſt on euery ſide yeeldeth moſt immediate aſsiſtance. For the narrower ſide of the ſtomacke toward the right hand, is in a manner hid vnder the Liuer; the left lieth cloſe to the Spleene and ſo of the reſt, which are all as ſo many coales ſet together vnder a veſſell to make it boyle. After the Aliment is concocted, the *pylorus* or lower mouth of the ſtomacke is looſened, and the Chylus thruſt downe into the *duodenum*, from thence to ſupply Aliment to the whole body: and ſo much of the ſtomacke.

Of the Oeſophagus or Gullet. CHAP. X.

The reaſon why we diſcourſe of the gullet in this place.

NOw although the *Oeſophagus* or gullet is (for the moſt part of it) ſcituated in the Cheſt or ſecond Region; yet becauſe it is continued with the ſtomack in ſubſtance, membranes and fibres little differing from it, being nothing elſe, but as it were a production of the ſame; we will intreate of it in this place, and not in the ſecond Region, the rather becauſe the Table wherein the ſtomacke is deciphered, contayneth alſo the delineation of this *œſophagus*. It is called therefore in Greeke by *Hippocrates*, *Galen*, and *Ariſtotle*, διεοφάγος from διὰ καὶ φάγημα, which ſignifieth to carry meat, as alſo στόμαχος the ſtomack, from words that ſignifie length and narrowneſſe. For indeed this name of the ſtomacke is proper to this part, albeit other authours, eſpecially our Engliſh toung hath turned it to ſignifie the ventricle or place where the meate is contayned; the true ſtomacke we call the gullet: the Arabians call it *meri* and *veſcet*, the Latins *Gula*. It is the common way of meat and drinke from the mouth into the ventricle or ſtomacke as we call it, which all creatures haue

The names. *Hip. lib de reſect. corpor. Gal 6. vſu part. 5. Ariſtot. 1. hiſt. Animal. 16.*

haue that draw breath. This part taketh his beginning in the lowermost cauitie or hollowneſſe of the throate, at the rootes of [table 10.figure 1,2.[A] the *orifice* of the gullet cut from the throat] the toung behind the larynx or wezon to whom it is tyed, and on either ſide toucheth the Tonſils or Almonds [tab. 10, fig. 1,[E E]] and paſsing through the necke & the breaſt, betwixt the wezon and [as appeareth in the table belonging to the chap.of the Lungs, figure 1,2. where [A] ſheweth the gullet, and [B] the arterie] the ſpondels of the necke and breaſt vppon which it leaneth; (for it might not paſſe through the middle cauitie of the breſt, leſt it ſhould trouble ſome Inſtrument of breathing, and beſide it ſtood in need of ſome ſetled ſupporter and that farre within, to leane vnto, that ſo it might be ſafe from externall iniuries) it goeth directly [Tab.x.Fig.1,2.from [A] to [B]] to the fift Spondell of the breaſt, where it enclineth it ſelfe a little to the right ſide, that it may [Tab.x. Fig. 1. from [B] to [C]] giue way to the trunke of the great Artery deſcending, which comming out of the left Ventricle of the heart, goeth neceſſarily to the left ſide ward. When it hath atteyned to the ninth Spondell, it is lifted aloft by the helpe of certaine Membranes, and paſſeth aboue the great Artery, leaſt in the deſcending of groſſe and thicke meates, it ſhoulde lye heauy vpon it, and hinder the courſe of the arteriall blood and ſpirits. Then againe it enclineth to the left ſide [Tab.x.Fig.1 from [C] to [D]] where the vppermoſt mouth [Tab.x.fig:1, 2 [C]] of the ſtomacke is ſcituated, and going vnder the hollow Veine, paſſeth through the Neruous part of the *Diaphragma*, by a poſterne of his owne into the lower belly, and is implanted not into the right, leaſt it ſhould neceſſarily perforate the Liuer, but into the left orifice of the ſtomacke, together with two Nerues [Tab.x.Fig.1,2 [T Y].]

To what parte it is tied

In his originall or riſing, it is tyed to the throate by a coate that compaſſeth the mouth, but to the ſtomacke (where it groweth to the *Diaphragma*) by the continuation of his body: to the bodies of the Spondels, to the weazon and the parts adioyning, by the helpe of Membranes proceeding out of the Ligaments of the backe.

The Figure of it.

His figure is round, [Tab.x fig.1,2] both that more matter might paſſe in leſſe roome, (for of all figures the round is moſt capacious) and that it might be ſafer from iniuries: very long it was of neceſsity to be becauſe the mouth is farre from the ſtomack; and it may well be called a reddiſh gut, for after that manner it is diſtended into a ſufficient capacity, that the meate ſhould not ſtay in it, or preſsing the weazon hinder reſpiration, and put a man in danger of choaking.

The ſubſtance.

The ſubſtance of it is in a meane betweene fleſh and ſinnewes, (wherefore it may bee both enflamed and ſubiect to convulſion alſo:) ſinnewy or membranous, that it might be extended into length and bredth when the meate is put in, and againe fall, that it take not too much roome when it is empty; fleſhy it is alſo, that being ſoft it might giue way vnto the meate as it paſſeth downe. But becauſe as a ſacke to be filled with Corne, vnleſſe it be held vp and open, doubleth into it ſelfe when the corne is powred in; ſo the Gullet being ſoft, ſhould double into it ſelfe, when the meate is powred into it; it is ſupported and held open by his connexion to the bodyes of the Spondels. Hence it is, that lying vppon the long ridge bone when it is affected, we apply Cataplaſmes to the ridge of the back. It hath three Coats, one common, and two proper. The firſt bred out of the Ligaments of the Spondels, which is the Caſe or couer of the two proper Coates. The ſecond, which is called the external, is fleſhy and very thicke, as if it were a perforated Muſcle, and hath his originall from the ſecond Cartilage of the Weazon, as it lookes toward the necke, & hath onely tranſuerſe Fibres, that with theſe the Aliment that is drawne by the fibres of the inner coate might be more readily thruſt into the ſtomacke; they are alſo a great help when the ſtomack violently laboreth to vomit vp any thing that oppreſſeth it: which two things are after a diuerſe manner performed. For if the fibres do beginne to be contracted aboue, they ſerue to ſwallow with: if from the Orifice of the ſtomacke, for vomiting. The thirde coate is internall, and of a diſsimilar ſubſtance; vnder or within whoſe inward ſuperficies, a certaine ſmooth and ſlippery veyle or wimple is ſubſtrated, hauing right and ſlender fibres to draw the noriſhment after the mouth hath receyued it. The remainder of his ſubſtance from which that veile or filmy couering like the Cuticle from the skin may be ſeparated, is Neruous and more Membranous then the externall, more harde alſo and ſenſible, that the pleaſure and good reliſh of meates and drinkes may be better apprehended by contaction or touching. This Coate ariſeth from that which inueſteth the palate, the mouth, lips, and throate; and runneth as farre as the left Orifice of the ſtomacke. It hath very few oblong fibres, leaſt they ſhould keepe the meate too long in the gullet, which would haue

His conexion

The 3. coates of the gullet.

beene a great annoyance to the wezon. That theſe may be the better obſerued, they had neede be parboyled, to take away their aboundant moyſture.

The act of ſwallowing. The act of deglutition or of ſwallowing, is a worke mixed of an Animal and Natural, & is helped by certaine muſcles called *æſophagæi*, belonging to the gullet; but they are accounted among the muſcles of the weazon, which proceeding from the ſides of the griſtle called *Thyroides*, doe wholly embrace the gullet; and being parted by a right line, are inſerted into his middle part, as we ſhall ſee more at large in the booke of muſcles.

The Glãdules or Tonſils called the Almonds. For the facilitie of ſwallowing, the cauity of this gullet is alwayes moyſtned by the glandules that are ſet neare vnto it. In the throate by the glandules that are common to the gullet and to the wezon, which containe the ſpattle, and [table 10, figure 1, ᵘᵘ] are called *Tonſillæ* or the Almonds; again, by a glandulous body that on the backſide, [table 10. fig. 1, 2. ᵛᶠ] and toward the ſides groweth to his middle paſſage, commonly in a Calfe called the ſweet-bread; as well to moyſten his cauity and defend him from the hardneſſe of the ſpondels, as alſo to hold him ſteady from inclining to either ſide.

His veſſels. Veines. Arteries. It hath veines, but very few, from the hollow veine and the Coronarie braunch of the [table 10, figure 1.2. ᵈ ᵈ] port or gate veine; Arteries from the great Arteries deſcending trunke, and from the coronarie branch of the *Cæliacall* Arterie [table 10. figure 1.2. ᵈ ᵈ.]

Nerues. His Nerues are very notable, comming from the ſixt paire [table 10. figure 1, 2. ᵗᵛ] which for ſecurity ſake are carried ſide-long; (the oblique way being much more ſafe then the right) for being ſoft and ſlender, and to be led a long way, they might eaſily bee ſtretched or broken by the waight of the ſtomacke, if they had been led right on: which nerues when they haue encompaſſed the gullet round, at length are faſtned in the ſtomacke, [tab. 10. fig. 2. ˣʸ.]

The vſe of the gullet. The vſe of this *æſophagus* or gullet is, that by it as it were by a tunnell, the meate and drinke, a little altered in the mouth, and turned ouer the rootes of the tongue by his muſcles to the beginning of this gullet, might by it be receiued, whither when it is ariued, the throat and parts of the gullet aboue the meate cloſing themſelues, and thoſe below being dilated, the meate and drinke are driuen downe into the ſtomacke.

It is worth the obſeruation, that with ſome men ſolid bittes finde freer paſſage then liquid drinks or broths, which are often returned into the noſe, and this hapneth vſually in thoſe who haue beene long afflicted with the Collicke.

A pretty obſeruatiõ with the reaſon of an vncouth accident. The cauſe of this accident is to bee imputed to the reſolution of the muſcles of the choppes, for ſolid things with their waight offer a kinde of violence to the muſcles, and make their owne paſſage, but liquid things cannot doe ſo. Although I am not ignorant that there may alſo be another reaſon rendred hereof, to wit, a tumor or inflãmation of the glandules before mentioned; for ſolide meates doe preſſe them and ſo open the cauity, to make way for themſelues.

Of the Spleene or Milt. CHAP. XI.

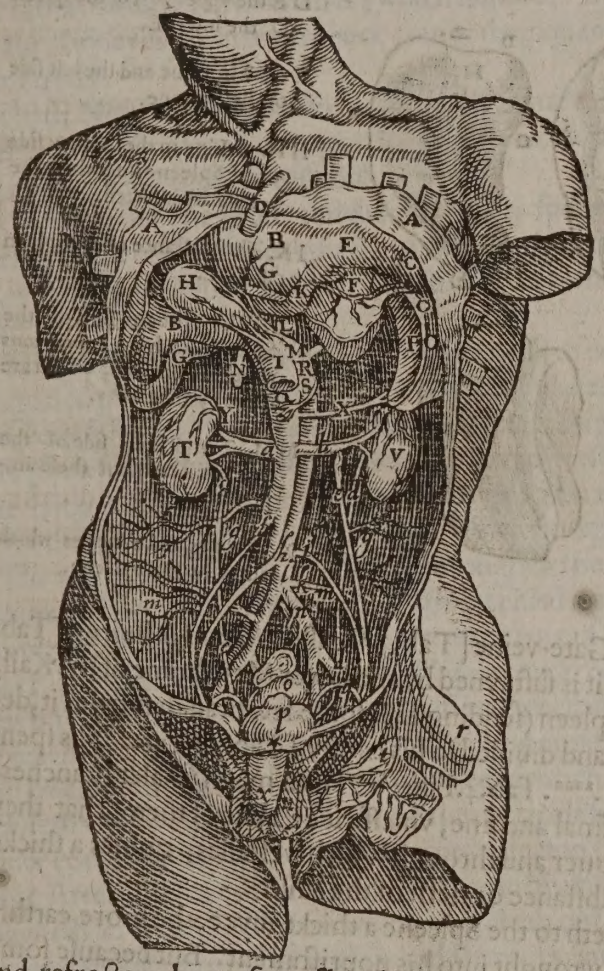
THE Milt is called in Greeke σπλὴν, becauſe it draweth away the droſſe of the bloud, as they ſay Lupines among wheate doe ſucke away the bitterneſſe of the earth; in Latine it is called *Lien*. It is placed in the [table 11.°°] vppermoſt part of the inferior *venter* or lower belly, in the left *Hypochõdrium*, vnder the midriffe towards the backe: wherefore in hayle men it cannot be felt, but in thoſe that haue ſwollen ſpleenes, it may not onely be felt, but ſometimes ſeene to bunch out a good way in the *Abdomen*. The embowed part [table 11.°°] reſteth vpon the ſpondels and baſtard ribs which are a defence vnto it; the concaue or hollow part [table 11. ᵖ] turned to the right ſide, is oppoſite to the Liuer, as if it were a left Liuer. It is ſeated either higher or lower in diuerſe bodies, betwixt the ſtomacke and the ribs, for there onely was a roome empty for it. Commonly there is but one ſpleene, yet ſometimes two and three one on the top of another; neuer of an equall bigneſſe, but diſtinct in their coates and veſſels: it is wondrous rarely abſent, and very rarely doth it change places with the Liuer, that it ſhould be in the right ſide, and the Liuer in the left. It is knit to the Rimme or *Peritonæum* and the *omentum*, ſometimes more outwardly to the *diaphragma*, and to the externall membrane of the left Kidney with very ſlender membranes, ariſing from the *Peritonæum*, where it compaſſeth the *Diaphragma*, for it had not neede of ſo ſtrong bands as the Liuer, becauſe it is nothing ſo waighty, ſometimes inwardly, forward to the ſtomacke, backward

to

to the backe alwayes, by the interpoſition or mediation of veſſels, and of the vpper Membrane of the *Omentum* [Tab.xii fig: 2 CC] which cleaueth to the Line [Tab.xi P. Tab. xii. fig: 2 RR] of the Spleene.

It varieth much in his Magnitude, colour, and figure. For in a man it is thicke and great, but much leſſe then the Liuer, that it may not hinder the dilatation of the ſtomack. In ſome men it growes greater; for by reaſon of the looſe rarity of his ſubſtance, it eaſily encreaſeth by the affluence of humors; eſpecially it groweth in thoſe men in whom naturally there is more plenty of Melancholy iuice: and although this humor in reſpect of the Choller and Vrine be but little, yet becauſe it muſt be drawne a long way, and is ſtubborne

TABVLA XI.



O O. The fore-ſide and hollowe ſide of the Spleene, which alſo ſheweth how his poſition is in the body of Man.

P. A Line into which the Veſſelles of the Spleene are implanted.

and refractary by reaſon of his thickneſſe and vnwilling to follow, therefore the Spleene is ordained ſomewhat the bigger. It hath not alwayes the ſame colour. For in an Infant when it is nouriſhed with pure blood defecated by the mothers Spleen it is red like the Liuer; but in growne bodies where it is nouriſhed with a thicke iuice, it is more then ruſſet toward blacke; for ſuch is the naturall colour of the Melancholy humor. But in thoſe that are diſeaſed in their Spleenes, ſuch as is the humor that offends, ſuch is the colour of the Spleene, Liuid, Leaden, Aſhy or Leeke greene; ſometimes it is couered with a coate very like a Cartilage, in colour, thickneſſe, and hardneſſe; in Dogges, it is of a brighter red then the Liuer. The colour. A good note.

His Figure [Tab.xii.fig.2] he varieth according as the parts which lye neere him do require, yet is alwaies ſo long as the vncouered or naked left ſide of the ſtomacke will admit It is alſo broad, and ſomewhat ſquare like an Oxe tongue, or as *Hippocrates* hath it, like the ſoale of a mans foote. Aboue it is broader, and ends in a double obtuſe & blunt Angle or corner. Below narrower, and ends in one narrow corner or angle. Without and on the left ſide, and as it looketh to the *Diaphragma*, ſomewhat gibbous or embowed, ſo that it hath a little repreſentation of a globous or round figure. Sometimes from the ribs it hath [Tab.xii.fig:4 LL] certaine impreſsions or diſtinctions. Inward, and on the right ſide ſomewhat concauous [Tab.xii fig:2 betweene RR] or hollow, that it might giue way, or rather encloſe the ſtomacke, and ſo further his concoction. Through the middle length of this The Figure.

cauity, runneth a white line [Tab.xi.[P] and Tab.xii, figu: 2 [HH]] which hath some rising inequalities in it, which receyueth the Veines and the Arteries [Tab.xii.fig:2 [N]] and the Kell [Tab.12 fig:2 [BB].]

The second Figure sheweth all the sides of the Spleene taken out of the body. The first the fore-side with a part of the Kell and his vessels. 2 The hollow side, 3 the gibbous side, the 4 sheweth the impressions which sometimes it receyueth from the Ribbes, the fift sheweth the hollow side slit open.

A. The left side of the Spleene, for the right and the middle part is couered by the Kell.

BB. The lower wing of the Kel, in which the vessels are led.

CC. The vpper wing of the kell, thorough which the vessels passe to the stomacke.

DE the vpper part of the spleen D. the lower E.

FG. The right and the left side of the Spleene.

HH. A Line in the hollow side of the Spleene into which the vessels are inserted.

IK. The substance of the Spleen dissected.

LL. The gibbous side of the Spleene, with the impressions aboue mentioned, which are made by the ribbes.

MM. The gibbous side of the Spleene, without these impressions.

N. Veynes and Arteries which run vnto the Spleene.

TABVLA XII.

The Milt or Splenicke branch of the Gate-veine [Tab.3 [B]] called *Ramus splenicus*, [Tab. 3 [F]] below the Liuer is sent (a great bow it is sustayned by the lower Membrane of the Kall, [Tab.xii.Fig.2 [BB]]) ouerthwart to the Spleen (sending first some few branches from it, described in the history of the port-veine) and diuided in his cauity, [Tab.xii.Fig:2 [HH]] is spent in his substance [Tab.xii.Fig.2 [KK] Tab. . [aaaa]. Tab.4.Fig:2 [llm]] into much smaler branches, not conspicuous as in the Liuer, but so smal and fine, vnlesse it be a few of them, that they rather seeme to be Fibres then vessels: ouer and through which vessellles, runnes a thicke and grosse blood, making the proper substance or flesh of the Milt.

The course of the Melancholy humour.

This Milt or splenicke branch carrieth to the Spleene a thicke iuyce, the more earthie part of the blood, that there it might be wrought into his nourishment. But because some part of this iuyce is so grosse that it cannot be attenuated by the Spleene, and therefore as vnprofitable must be segregated or separated, there are ordained two kindes of Vessellles to receyue it; one which belcheth it out vpward into the left side of the bottome of the stomacke, sometimes vp higher toward the left orifice, where with his sowreneſſe he stirreth vp the Appetite after the Chylus is gotten into the Veins of the Liuer: so wee imitate nature, when we make sowre or snarpe sauces at supper, to prouoke and recall our appetite which by our dinner was extinct and lost. Againe, this humour hauing a binding faculty, strengthneth the stomacke, that his actions may be more firme.

How Melancholy prouoketh appetite.

This regurgitation or belching of melancholy, is made sometimes by three, sometimes by many Branches proceeding from the splenick branch; sometimes by one, proceeding from the vppermost branch neere the Spleene, which *Galen* calleth *Vas breue*, that is, the short Vessell, described before in the 3. and 4. Tables. Hence comes sometime castings of a blacke humor, which is after carried downe the guts with the Chylus, and so excluded. This Vessell also is of great vse in Quartane Agues; for by it such patients are to good purpose by vomit purged, before and after the fit: for in these Agues, as also almost in all melancholy diseases, not onely the Milt but the mouth of the stomacke is affected. There is also another vessell by which this humour is carryed downeward, which beeing inserted at the end of the right gut, maketh the inwarde Hæmorrhoidal [Tab.3.[ss]. Tab. 4. Fig: 2,*] Veines, for the outward come from the Hollowe veine; although this humour bee often purged

Vas breue.

Vomits how good in quartane Agues.

purged by the Arteries, not onely into the guts, but more often into the emulgent veines, and ſo through the Kidneyes into the bladder. And ſo wee immitating Nature in melancholly diſeaſes vſe diureticks, or medicines prouoking vrine. Diuretick medicines in quartane agues & melancholly diſeaſes.

The ſpleene alſo receiueth many Arteries (more then the Liuer) and thoſe very [Table 4. figure 1.[n]] great, the Cœliacall [table 4. figure 1.[m]] which commeth out of the *Aorta* or great Arterie vnder the *Diaphragma*, after the ſame manner and with the ſame number of diuiſions that the veines haue, not onely that they may affoord him life, but alſo that by their perpetuall motion they might preſerue in good ſtate the body of the ſpleene, by ventilating, cheriſhing, and refreſhing his naturall heat, almoſt oppreſſed with a droſsie iuyce, which iuyce they change into a thicke bloud for the ſpleenes nouriſhment, and the droſſe is purged or auoyded away as wee haue ſayde. Beſide, theſe Arteries carry to the *Aorta* wheyey humors, together with a thin and cold bloud, which are receiued by the *Anaſtomoſis* or inocculation of the veſſelles; which humours by the emulgent Arteries are deriued into the Kidneyes; and from hence comes that quantity of vrine or whey which is in the great Artery. The Arteries.

It hath Nerues inſerted into his coate very ſmal ones, from that branch of the ſixt paire which commeth from the rootes of the ribbes on the left ſide, but whether they paſſe farther into his ſubſtance we yet doubt. The nerues.

It hath but one coate, and that very thin, ſpringing from the membrane of the Kall, which we ſayd claue to the right line of the ſpleene, and was a production of the *Peritonæum*, which coate compaſſeth and defends his fleſh on euery ſide, becauſe it is very ſoft and looſe.

His ſubſtance [table 12. figure 5.[18]] ſeemeth to be nothing elſe but a thicke blacke and congealed bloud ful of fibres, for it is a *Parenchyma* as *Eraſiſtratus* called it, or a fleſhy affuſion, very ſoft, thin, looſe, and ſpongious, that it might more eaſily draw thick iuyces from farre (for a ſpongie ſubſtance is fitter for that purpoſe then a faſt and firme) and giue them entertainment: wherefore alſo the veines diſſeminated through it, are ſofter and looſer then others, that the humour may more eaſily, though it be thicke, fall out of them. The fleſh or *Parenchyma*.

The vſe of the ſpleene, *Eraſiſtratus* thought to be none at all; inconſiderately accuſing Nature to haue framed it in vaine. The receiued opinion is, that it was ordayned to bee a receptacle of the craſſer and more fœculent part of the bloud, made and ſeparated in the Liuer, like as the bladder of gall is the receptacle of yellow choller; that the bloud being thus on either hand depured, might paſſe more cleare and neate to nouriſh the body, and eſpecially the principall parts. This thick and impure bloud yet mingled with much good and laudable, the ſpleene by the ſpleenicke braunch of the gate-veine, by an inbred faculty draweth vnto it ſelfe as familiar and of kin vnto his ſubſtance; which albeit the veines of the Liuer could not change, yet the ſpleene by reaſon of the perpetuall motion of his many & large Arteries worketh it into his owne nouriſhment: of which notwithſtanding there remayneth an vnprofitable part which it belcheth out into the ſtomacke, by the ſhort veſſell to ſtirre vp appetite by his aciditie and ſharpnes, and by his adſtriction to corroborate and confirme the actions of the ſtomacke. But againſt this common receiued opinion, *Bauhine* in this place annexeth a long diſcourſe, full of wit, but how conſonant to trueth, I will leaue to others to iudge. It ſhall be for the preſent ſufficient to make his conceite knowne vnto you. *Eraſiſtratus*. The receiued opinion of the vſe of the ſpleene.

If the ſpleen, ſayth he, had onely beene appoynted to ſtable an excrement, it ſhould not haue been ſeated in the vpper but in the lower part of the *abdomen*, as the other receptacles of excrements are: for ſo woulde it more commodiouſly haue receiued ſo heauy and earthy an excrement. *Bauhines* conceit of the vſe of the ſpleen. His arguments.

Againe, ſeeing of all the humours there is leaſt quantitie of this melancholy, Nature would not haue made the ſpleene bigger then the bladder of gall, if ſhee had not intended ſome other office for the ſpleene, beſide the receite of melancholly.

Moreouer, if this had beene her only end, ſhe would haue framed in the ſpleene a large cauitie where this humour might haue commodiouſly beene entertayned, as ſhe framed a cauitie for the choller in the bladder of gall.

Fourthly, we muſt know and vnderſtand that no part ordayned for the ſeparation of excrements, doth receiue and naturally auoyd them by the ſame paſſages, as we may perceiue by the Kidneyes and the bladder of gall. Fiftly, no part is nouriſhed by the excrement which it attracteth but by laudable bloud. Sixtly, as the paſſages of choller are diſperſed through

through the ſubſtance of the Liuer, among the rootes of the gate and hollow veines, to draw away the excrementitious choller. So alſo ſhould there haue beene many propagations and tendrils from the ſpleenick braunch, diſperſed through the ſubſtance of the Liuer, which we finde to be nothing ſo.

Finally, if from the Liuer the fœculent bloud bee purged away, as an excrement into the ſpleene, then it muſt of neceſsity follow that this excrementitious humour ſhould regurgitate or returne into the trunke of the Gate-veine, becauſe the ſplenick branch ariſeth out of the ſame trunke far vnder the Liuer, and aboue the trunke of the *meſeraicks*.

Authors on *Bauhines* ſide. *Ariſtotle.* *Galen.* *Aphrodiſæus.* *Aretæus.* *Veſalius.* *Fernelius.* *Platerus.* *Archangelus.*

Wherefore we think, ſayth *Bauhine*, that the ſpleene was ordained and inſtituted by Nature, for a further confection of ſome kinde of bloud. Which vſe, *Ariſtotle* firſt allotted vnto it, and therefore in his third booke *de partibus Animalium* and the 7. chapter, hee calleth it a baſtard Liuer. The ſame alſo *Galen* giueth aſſent vnto, in his booke *de reſpirationis vſu*, as alſo *Aphrodiſæus* and *Aretæus*: *Veſalius* and *Fernelius*, touch vpon this vſe of the ſpleene alſo; but *Platerus* and *Archangelus* reſolue vpon it very confidently.

Bauhines proiect.

The ſpleene therefore from an inbred faculty of his owne, draweth vnto himſelfe the thicker and more earthie portion of the Chylus, ſomewhat altered in hauing receiued a certain diſpoſition or rudiment of bloud in the meſeraicke veines, by the ſpleenick branch of the Gate-veine, out of the trunke of the meſeraick veines before the Chylus get into the Liuer; that ſo the Liuer may the better draw the more laudable parts of the Chylus, for otherwiſe the ſmall veſſels of the Liuer being obſtructed by the craſſe and crude bloud, not onely ſanguification would haue beene interrupted; but alſo the Iaundiſe, Dropſies, Agues, Scirrous hardneſſes, and many other miſchiefes, woulde haue ouertaken vs of neceſſity; all which we ſee do euery day hapen when the ſpleen fayleth to do his duty; and either through weakneſſe or obſtructions, ceaſeth to attract that craſſe and fœculent part of the Chylus. But a great euidence of this trueth is this; that the ſpleenicke branch doeth not proceede from the Liuer, but ariſeth as is ſayde, and is ſeated below it. Neither is it likely that ſo thicke a iuyce confected and made into bloud in the Liuer, ſhould get out of it by the hairie and threddy veines of the ſame; yet wee doe not deny that melancholly iuyce is ingendred in the Liuer; but wee ſay, that that onely is there ingendered which is a part of the maſſe of bloud, not that which is receiued into the ſpleen, for his nouriſhment and the vſe of the ſtomacke.

Furthermore we are of opinion ſaith *Bauhine*, that a part of the Chylus is ſucked euen out of the ſtomack, by veines ariuing at the left ſide of his bottom from the ſpleenicke branch.

When the ſpleen hath receiued this Chylus a little altered in the long iourney through thoſe ſpleenicke ſurcles and branches, it laboureth and worketh it at great leaſure, and by a long proceſſe, as the Alchymiſts ſay, and much preparation in the innumerable ſmall veſſels or Fibrous complications which are diſſeminated through his ſubſtance (like as the other and greater part of the Chylus is laboured into bloud in the complications of the veſſelles diſſeminated through the Liuer) and boyleth it into a thinner conſiſtence by the help of naturall heate aſsiſted by the many and large Arteries, and their perpetuall motion. And then a part of it becommeth the Aliment of the ſpleen, the reſt is carried by veines iſſuing from the ſpleenick branch, to nouriſh the Stomacke, the Guts, the Kell, and the Meſentery;

Galen.

which thing *Galen* alſo inſinuateth, when he ſayth, That the ſame meſeraicke veines do carry Chylus vnto the Liuer out of the ſtomacke and the guts, and returne bloud againe vnto them and the *omentum*. For ſeeing that the originall and ſubſtance of all the veines which are propagated from the gate-veine is one and the ſame; it followeth neceſſarily, that their action alſo ſhould be the ſame; but to returne.

A part alſo happely of this humour thus altered is drawne into the next adioyning arteries, and ſo conueyed into the great Artery, to contemperate the intenſe and ſharp heat of the bloud in the left ventricle of the heart, and to eſtabliſh and ſettle the nimble & quick motions of the vitall ſpirits, which are a very great cauſe why ſome mens wits are ſo giddy and vnconſtant.

This is ſomewhat ſtrange.

Sometimes it falleth out in great and confirmed diſeaſes of the Liuer, when his ſanguification is decayed or in a manner periſhed, that the ſpleen performeth his office, and tranſmitteth a part of the bloud by him laboured through the ſpleenicke branch into the veines of the Liuer, which through the rootes of the hollow veine and the branches thereof, is diſtributed into the parts of the body for their nouriſhment, euen as the bloud is wont to be diſtributed, which is laboured and confected in the Liuer it ſelfe.

But

But that part of the altered Chylus that before we ſayd was drawn into the ſpleen, which it cannot by reaſon of the thickneſſe thereof transforme into profitable iuyce, but is altogether vnapt for nouriſhment, is poured out, part of it into the ſtomacke, part into the *Hæmorrhoid* veines; ſometimes through the trunke of the gate veine, or through the ſpleenick Arteries it is deriued vnto the Kidneyes, whence it is that in diſeaſes of the Spleene, the water fals out often to be blacke.

why in affects of the Spleen the vrines are often black.

Wherefore we conclude ſaith *Bauhine*, that the Spleene is a great helpe to the Liuer for the confecting of blood; partly becauſe it maketh blood anſwerable to his owne Nature, partly becauſe it auerteth or draweth aſide vnto it ſelfe the thicker part of the aliment, not ſo fit to make pure blood, and by that meanes the Liuer, vnburdened of ſuch a clogge, performeth his office of ſanguification with more facility. And thus it may be ſayde verie well to purge and defecate the blood, and to make it more pure and bright. And heerupon the Ancients placed the ſeate of laughter in the Spleene: and *Plato* ſaith, that the ſpleen poliſheth and brightneth the Liuer like a Looking-glaſſe, that it might make a more cleare repreſentation of the Images of the paſsions from thence exhibited vnto the ſoule.

Plato.

Ariſtotle alſo calleth it a left Liuer, and obſerueth that thoſe creatures which haue no Spleene, haue as it were double Liuers: and *Galen* remembreth in his fourth Book of the vſe of parts, and the 7. chapter, that *Plato* calleth it the expreſſe Image of the Liuer.

Ariſtotle.

It is therefore not to bee wondered at, if the diſeaſes of the Spleene doe no leſſe (haply more) hinder ſanguification then the diſeaſes of the Liuer it ſelfe, becauſe by howe much the better the Spleene doth his duty, by ſo much the bloode in the Liuer is more pure and cleare.

In Diſſections alſo we often finde, that the Spleene exceedeth the Liuer in magnitude, or is equall to it, being yet ſound in colour and conſiſtence.

Notwithſtanding, albeit in both theſe entralles, when a man is ſound and hayle bloud is generated, yet it muſt needs be confeſſed, that there is more ſtore of good and hot bloud fit for the nouriſhment of fleſhy parts made in the Liuer then in the Spleen, whoſe bloud is neyther ſo much, nor ſo hot, nor all out ſo good; which *Hippocrates* intimateth when he ſaith, that the ſame things which make the Spleene to flouriſh, make the body to wither and conſume.

And thus I haue acquainted you with *Bauhines* conceit of the vſe of the Spleen, wherein me thinks he acquitteth himſelf, as *Bellarmine* doth in his diſputations of the ſufficiency of works in our Iuſtification, who after that in diuers Books, and by manifold arguments he endeuoureth to proue that works may iuſtify, yet in the end he concludeth, that it is more ſafe onely to truſt to iuſtification by faith; ſo *Bauhine* for all his former arguments, yet you ſee concludeth, that the more, better and warmer bloode is made in the Liuer: as if hee ſhould ſay, there is a little & cold blood made in the Spleen, not fit to nouriſh the fleſhy parts, but onely his owne ſubſtance, which I thinke no man will deny vnto him. But of this queſtion we ſhall ſee more heereafter in the Controuerſies; we will now put an end to our diſcourſe of the Spleene, adding this one vſe more of it; That with his in bred heate, and the many Arteries wherewith that heate is encreaſed, it furthereth the concoction of the Stomacke.

Bauhines cautelous concluſion.

Bauhine likened to Bellarmine.

CHAP. XII. *Of the Liuer.*

THE Liuer is called in Greeke ἧπαρ, from a word that ſignifieth *Want*, becauſe it ſupplyeth the want of al the parts; or from making merrie, becauſe in this part is the ſeate of concupiſcence. The Latines call it *Iecur*, as it were *Iuxta Cor*, becauſe next to the heart his power is moſt eminent.

The rotation.

It is worthily numbred among the principall parts, as being the ſeate of the naturall faculty, and of the nouriſhing part of the ſoule, common to all ſanguine or bloodie creatures: and firſt of all the Entralles or bowels it is perfected in the mothers womb.

A principall part.

The beginning of veins.

It is the beginning of Veines, not in reſpect of their originall, which is ſeed (for the veſſels are made before the *Viſcera* or entrals) but in reſpect of their rooting & diſtribution; for from hence ſpring two great and long Veines; below out of his cauity or hollowneſſe the Port or Gate veine; aboue out of his conuexity or embowed ſide, the hollowe veyne is ſayde to proceede, albeit indeede the hollow Veine groweth to his backe [Tab. xiii. Fig: 2, FG Fig: 3 MN] part, with two notable branches diſperſed through his ſubſtance, which two veſſels

veſſelles ariſe out of the Liuer, the *Parenchyma* or fleſh of it being compaſſed about their roots as the earth is about the roots of a tree, and doe miniſter nouriſhment to the vvhole body, wherefore the Liuer is called the ſhop of ſanguification or blood-making.

His ſcituation. It is placed in the [Tab.6.lib.2 FF Tab.9.CC] vpper part of the lower belly, that being ſet in the middeſt as it were of the body, it might ſend bloud equally vpward and downeward; it is about a fingers breadth diſtant from the *Diaphragma* leaſt it ſhould hinder his motion; in dead bodies ſometimes it toucheth it, and is couered wholly by the ribbes. It taketh vp the greateſt part of the right *Hypochondrium*, partly that it may leaue the left for the ſtomacke [Table 6. *Lib.* 2. FF. Table 9. FF] and the ſpleen [Tab.9.e] (for theſe three occupy both ſides; whence it is, that when any of them, much more when all are ſwelled, ther followeth great difficulty of breathing) partly becauſe the bloud might be better carried to the right ventricle of the heart. It leaneth but lightly vpon the vppermoſt, foremoſt, and right ſide of the ſtomacke [ſee the Tab.6.*lib.*2. and Tab.9.] leaſt it ſhould preſſe it with his waight, and driue forth the matter contained in it. A little part of it alſo reacheth toward the left ſide, that the body might be ballanced. In Dogs it taketh vp well neere both ſides, becauſe their ſpleenes are long and narrow, but the greateſt part is compaſſed below with the baſtard ribs which defend it from iniuries.

The figure. His Figure is diuerſe, becauſe of the parts [Table 13. figure 1.2.] adiacent, for his office

Table xiij. ſheweth the Liuer with his Veines.

The firſt Figure, the Gibbous and forepart.

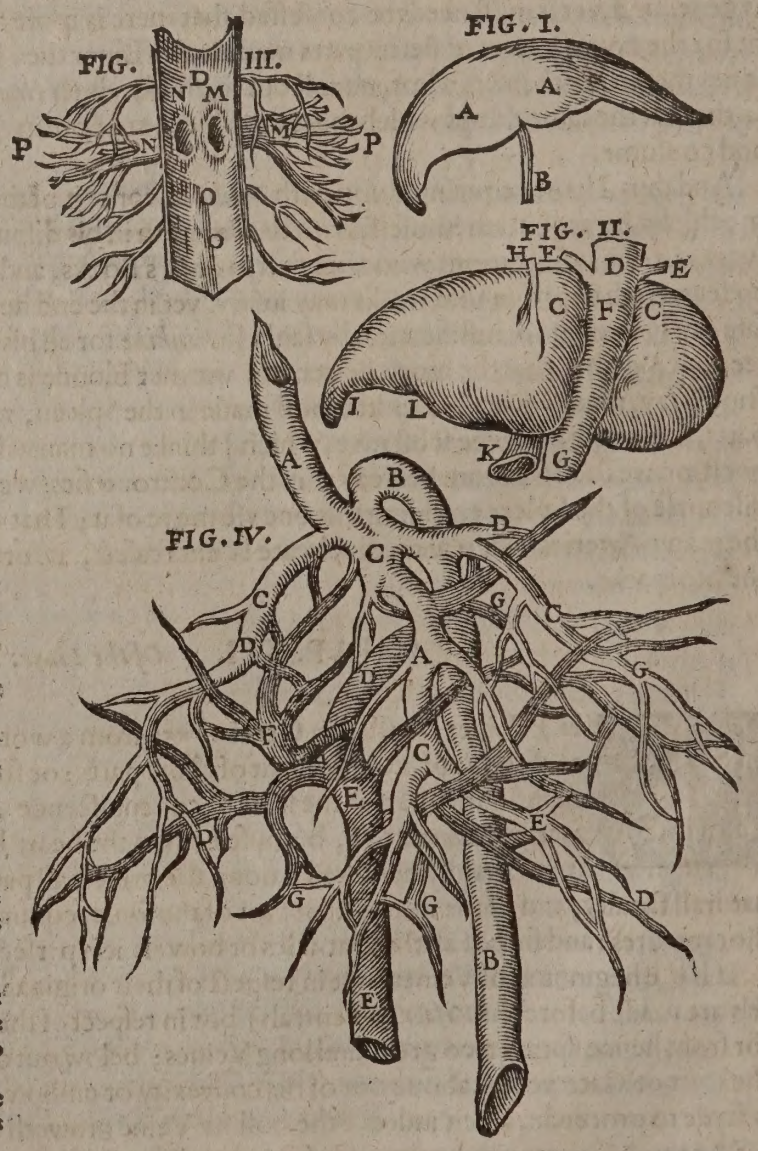
The ſecond Figure, the Gibbous and hinder part, together with a part of the trunk of the hollow veine.

The third Figure, a part of the hollow veine faſtned to the backſide of the Liuer, and is opened with a long ſlit, to ſhew the holes of his branches where they open into the Liuer.

A A 1 The Gibbous and foreſide of the Liuer.
B 1. The Vmbilical veine.
C C 2. The Gibbous and backſide of the Liuer.
D 2.3. The ſeate of the hollow veine where it paſſeth through the midriffe.
E E 2. The veines of the midriffe called *Phrenicæ*.
F G 2. In this diſtance is the place where the trunk of the hollow veine groweth to the backeſide of the Liuer.
H 2. A Ligament which tieth the Liuer to the midriffe.
I 2. A Ligament tying the left ſide of the Liuer to the midriffe.
K 2. A part of the Gate veine.
L 2, The boſome of the Liuer into which it admitteth the left orifice of the ſtomack.
M N 3. Certaine braunches of veines proceeding out of the Liuer.
O O 3. Smal braunches which are thruſt out of the Liuer to the hollow veine.
P P 3. The roots of the hollow veine diſperſed thorough the Liuer.

The fourth Figure ſheweth the rootes of the Hollow and Gate veines, diſperſed through the Liuer and their Anaſtomoſes or innocculations.

A. The trunke of the hollow veine ariſing vpward from the Liuer.
B B The trunk of the hollow veine, as it getteth out of the Gibbous part of the Liuer, which is bent downwards, and watereth al the parts of the body vnder the Liuer.
C C C C. The roots of the hollow veine which are in the ſubſtance of the Liuer.
D D D D. The ends of the roots of the hollow veine which pierce or open into the midſt of the roots of the gate-veine.
E E The principal trunk of the gate vein.
F F The roots of the gate veine, euen all thoſe that are black, diſperſed through the ſubſtance of the Liuer, which vnder the lower part of the Liuer do meet, and make one trunk.
G G G G The endes of the rootes of the gate veine which pierce or open into the midſt of the rooots of the hollow veine.



requires

requires no proper figure, but a ſufficient magnitude and thickneſſe.

The form of it is outward or inward; the outward forme or ſurface, which is the vpper & more backward part is ſmooth, equall and conuexe or embowed [Tab. viii. [B C] Tab. 2 lib. 4 [bb], Tab, xiii. Fig. 1 [AA], Fig: 8 CC] round (which is called *pars gibba*, the gibbous part or the head) that it may giue way to the *Diaphragma*, and may agree with the cauity of it; but backward it hath a [Tab. xiii, Fig. 2 at [F G]) long boſome ſufficient to embrace the ſtumpe of the hollow veine [Tab: xiii, Fig. 2 [F G]] leaſt it ſhold be preſſed eyther with the Liuers waight or the motion of the Midriffe. The Figure.

The inward face of the Liuer which is the lower, is [Tab. 8 CC. Tab, xi, [BB]. Tab: xv, Fig. 1 [B BC]] hollow, vnequall, and is called the *Simus* or ſaddle ſide, that it may giue way to the ſtomacke ſtrutting [Table 9. [FF]. Tab. xi [B]. Tab. 2, lib. 4 [cc]] with plenty of meat, and couer it immediately to cheriſh the firſt concoction of the Chylus.

In this part there are two hollowes or boſomes, one on the right ſide to receiue the body of the bladder of Gall, [Tab. xv: Fig. 1, [P]] the other on [Tab: xiii: Fig: 2 [L]. tab xv. Fig; 1 [R]] the left ſide, where it giueth way to the paſſage of the ſtomacke. In Dogs it hath a priuate hollowneſſe, whereinto it admitteth a part of the right Kidney. But where the gate-veine getteth out of it, it is vnequall, becauſe it riſeth ſomewhat high, leaſt the Veines ſhould be preſſed by the rack-bones. On the Right ſide it is round [Tab. 9 [cc] Tab: xiii, Fig: 1, [AA]] and very thicke; on the left it groweth thinner by degrees, and endeth ſomewhat ſharpe in an acute Angle; [Tab. xiii Fig: 2. from [L] to [T]] in the forepart alſo it is thin in the bought or compaſſe. There is but one Liuer, for the largeneſſe makes recompence for the number; and it is the greateſt in a man of any creature for his proportion, and in the biggeſt men biggeſt, becauſe it muſt make blood for the vſe of the whole body; not onelie for his nouriſhment, but alſo to ſerue for his expence of ſpirits: for there are more functions of the ſoule in a man, then in anv other creature; which functions ſpend more animall Spirits, and thoſe are engendred of the vitall ſpirits, and the vitall ſpirits of blood; therefore a man had neede of good ſtore of blood, and by conſequent of a great Liuer wherewith to make it. In fearefull men and ſuch as are giuen to their paunches, it is greater then in other men. In fearefull men, becauſe the weakeneſſe of their vitall faculty comming of the cold temper of the body, might be ſupplyed by the ſtrength of the natural faculty. In rauenous gourmandizers, becauſe of the aboundance of the meate they eate; for as the Liuer is more plentifully nouriſhed, ſo it groweth greater. For the moſt part the Liuer of a man is whole (that when a man goes right vp, it might couer the ſtomacke with the hollow part of it) [as is ſhewed in the 6 Tab. lib. 2. and in Tab. 5] excepting the fore and right part wher there [Tab: xiii. Fig: 1. at [B] Tab. xv Fig. 1, [F]] is a cleft like an outler, which was neceſſary for the paſſage of the vmbilical or nauil vein. [Tab. 6, lib. 2, from [D] to [B], Tab. 5 [c]. Tab. 8 I. Tab. xiii. fig: 1 [B]] On the backſide a part of it filleth the cauity, which both the mouths of the ſtomacke do leaue. The waſte of ſpirits in man aboue other creatures. In what men it is greater or leſſer.

But in bruite beaſts it is diuided into foure, fiue, or ſix Lobes or Finnes, which are continuated or coupled together, onely by the mediation of Veynes, within which lobes their ſtomackes are couered as it were with the fingers of a hand, becauſe they haue no cloathes to keepe it warme, as men haue. For if in them it were whole, when they go groueling it would not ſo lap about the ſtomacke, but hang off. Wherefore Birds becauſe they ſtande more ſtraight vp, haue it diuided but once. It hath in me no Lobes or diuiſions.

It is knit to the ſpine bone of the Loynes, to the *Diaphragma*, and to other parts by the helpe of the rim or *Peritonæum*, of whom it receyueth three ſtrong Ligaments, leaſt being heauy, it ſhould at any time fall. The firſt and right is thin [Tab, 5 [D], Tab. 8 [H], Tab. 2 lib. 4. [d]. Tab xiii. Fig: 2 [H]] like a Membrane, broad, neruous, and very ſtrong, proceeding from the Rim where it compaſſeth the Midriffe; and tyeth the Liuer (into whoſe coates it doth degenerate) forward to the *Diaphragma*, and is called *Suſpenſorium* or the heauing Ligament: wherefore, when the Liuer growes heauy, the Midriffe is drawne downe, and in reſpiration there is more difficulty when a man ſtands, then when he lies along. The ſecond and left Ligament is alſo very ſtrong, round, [Table xi. C. Table ii, lib. 4. [e]. Table xiii, figure ii, I. Table fifteene, figure one, [G]] and proceeding from the Rim; it knitteth alſo his thinner part to the *Diaphragma*, that the ſides of the Liuer may on either hande bee held vp, it ſometimes alſo cleaueth to the Cartilages of the baſtard ribs. The third Ligament is the vmbilicall or Nauell veyne, now dryed after [Tab. 6 lib 2. from [D] to [B]. Tab. 5 [E], Tab. xii: Fig. 1 [B]] the birth, whereby at the Nauell it is tyed down to the *Abdomen*, [Tab: 23 The Conneꝛion. Three Ligaments.

Fig.

Fig:7,8.from [z] to [y]left the Liuer falling down should draw the *Diaphragma* after it. Moreouer, where the beginning of the gate-veine is [Table 11.[i]] there groweth to it a portion of the *omentum*. So on the backside in the compassed face or gibbous part where the hollow veine passeth through it, it cleaueth to the rim.

The membrane.

It hath a most fine and slender membrane, and but one, growing from that membrane of the veines which ariseth from the *Peritonæum* or rim; and this incloseth all his substance.

The *Parenchyma*.

That substance is nothing else but bloud poured out of the veines, whence it is red and soft, and standeth round about and betwixt them, as the earth about and betwixt the small bearded rootes of a tree; which bloud being held in by the membrane wee last spake off, cloddeth together, and therefore of *Erasistratus* is called παρέγχυμα, that is, an affusion or pouring out. *Galen* cals it flesh, *Hippocrates* a fleshie *viscus* or entrall: wee with *Galen* call παρέγχυμα, the flesh as well of this as of the other entrals.

The empty spaces betweene the rootes of the hollow and port veine this substance filleth vp, as may appeare when the flesh is taken away, for so it may be as we haue seene elegantly performed, especially by that occulate Anatomist *Petrus Pauius* of *Leydon* neere xx. yeares since, then my first Maister & Moderator in Anatomie; a liuely resemblance whereof wee haue here annexed, albeit it may partly be perceiued by the precedent Table.

Table xiiij. Sheweth the rootes of the Hollow and Gate veines, disseminated through the Parenchyma or flesh of the Liuer, & their Anastomoses or inocculations: also the trunkes of the Nauell, Hollow, and Gate-veines. Into euery one of the trunks you may put a sticke before you boyle the Liuer and separate his substance from the vessels, that so the vessels may appeare open, and not corrugated or crumpled vp together.

TABVLA. XIIII.

A The trunk of the hollow vein where it pierceth the midriffe

B *A* part of the midriffe.

CC A parte of the trunke of the hollow veine which groweth to the back part of the Liuer.

DD The trunke of the hollow veine which is carried thorough the lower belly, his brãches being remoued.

EEEE The roots of the hollow veine dispersed through the substance of the Liuer: these appeare here all white.

FG The vmbilicall veine, without the Liuer at F. within the Liuer at G.

HH The trunke of the gate vein without the liuer.

II A part of the right side of the gate veine torne from his left side, that the vessels might better bee demonstated: but the trunke of the gate veine HH, should haue ridden ouer the hollow veine D D.

KKKKKK The roots of the gate veine dispersed through the substance of the Liuer, which here appeare all blacke.

LLL The *Anastomoses* or inocculations of the rootes of the gate veine with the rootes of the hollow veine.

M This innocculation is like a Pipe or trunke, & it is a common and continued passage, into which you may put a good big Probe: from this there are open passages into the last strings of the gate or hollow veine.

The roots of the great veines.

There are a few Arteries inordinately shed through his substance amongst the other vessels: But there are more rootes of the port veine [table 13. figure 4. Table 14. the blacke rootes belong to the gate veines] in his lower part, and fewer in his vpper, and on the contrary

trary many more [Tab:xiii,Fig.4. Tab.xiiii the white rootes belong to the Hollow veine] roots of the Hollow veine in his vpper parts, then in his lower, (wherefore there is more plentifull ſanguification or making of blood in the hollow ſide, and more aboundant diſtribution in the conuex or embowed part) but all of them committed acroſſe or mixt together by Anaſtomoſis, [Tab.xiii: Fig.4. GGGG, Tab. xiiii: LLL] which moſt reſembleth the inoculation of plants; althogh ſomtimes the roots of the hollow Vein do faſten their ends into the midſt of the roots of the Gate-vein, by which the bloud runneth out of the roots of the Gate vein into the Hollow vein, ſo that theſe roots do make *plexum mirabilẽ*, or the wonderfull web, texture, or plat of Veines (in reſpect of which it is likely the Liuer is ſaide to be the beginning or originall of veynes) for the perfecting and abſolute confection of the blood. But there is one peculiar and notable Anaſtomoſis or inocculation to bee obſerued [Tab.xiiii, M] which is a manifeſt and open pipe and continuated paſſage into which you may paſſe a good bigge probe, and from which there lyeth an open way through all the leaſt threds of the Gate and hollow Veines. And ſo much the rather are theſe inocculations of the Veines one with another, more diligently to be obſerued, becauſe through them the humors offending paſſe, when the habite or vtmoſt region of the body is by purgation emptied by the ſiedge.

Anaſtomoſis what it may beſt be compared to.

The lower [Tab.xiii, Fig.4, FF. Tab:xiiii. KKKK] of theſe roots, are by little and little gathered into greater, and theſe into other, till at length in the lower part of the Liuer they conſent together into the trunke of the port or the Gate veine [Tab.xiii, Fig.4. EE Tab:xiiii HH] as broad as a thumbe or broader.

The port of Gate-veine. The Holow veine.

The vpper roots are in like manner [Tab:xiii.Fig:4. CCCC, Tab.xiiii, EEE] vnited by degrees, till at length they fall into two notable and great [Tab.xiii, fig:3, M N] braunches, reaching to the fore-ſeate of the Hollow veine, where it groweth to the Liuer, and lyeth vpon the *Diaphragma*, and there make one trunke [Tab. xiii.figure:2.F, fig:3, P. fig:4 B. Tab, xiiii, AC.] Hence it is that the Gate veine [Tab: viii, A] is ſaide to ariſe out of the hollow ſide of the Liuer, and the Hollow veine, [Tab: viii, K] out of the conuex or embowed part.

Amongſt theſe roots, certaine fine tendrils [Tab:xv fig:2, ♌. Table xvi, figure 1, DDD, figure 2, AAA] hauing the bodies of Veines, and being gathered into one ſtumpe or ſtalke [Tab: xv, figure 2a. table xvi, figure 1, R] are diſſeminated, which carry the choler from the Liuer to the bladder of gall, which alſo are ioyned with the rootes of the gate-veyne, that the blood before it come into the branches of the Hollow veine, may bee purged and clenſed from that cholericke excrement.

The paſſage of Choller to the bladder, or Gall.

The ſame ſubſtance of the Liuer whereof wee ſpake before, by compaſsing about theſe veſſels, ſtrengthneth them, and warranteth their tender threds from danger; by whom alſo it receyueth in lieu a proportionable good, for it is nouriſhed by blood laboured in the roots of the Port veine, and out of thoſe ſmall ends powred on euery ſide into his lap: the remainder which he refuſeth, is carried into the roots of the hollow vein, and thence both thruſt out, and drawne for nouriſhment into the whole body.

How the Liuer is nouriſhed.

There are a few ſmall Arteries [Table 4, figure 1 M] from the *Cæliaca* diffuſed in his ſubſtance (which do appeare more vvhite then the Veines) on the hollow ſide where the branches of the Gate [Table 4, figure 1 E and figure 2, Y, table xi. L] veine do ioyne together into their common trunke or ſtumpe, that they might ventilate and ſo preſerue the naturall heate of the Liuer, wherfore they runne onely through the hollow part; for the embowed part is wafted with the continuall motion of the *Diaphragma*, as with a Fan. They alſo carry vitall heate, that the heate being doubled, the ſanguification might better ſucceed; and that the Liuer alſo might not be deſtitute of the vitall faculty: for in the whole bodye, the Veines and Arteries are in a league and helpe one another: theſe miniſtring ſpirits to the veines, the veines blood to them.

The Arteries of the Liuer.

It hath two ſmal Nerues [Tab: iiii, fig:2. Y tab: xi M] from the ſixt paire: one from that branch that is ſent to the vpper mouth of the ſtomacke; [tab:xv. fig: 1 °, tab. xvi, fig:1 O] the other from the branch [table xv. Figure 2 F] which paſſeth to the roots of the ribbes of the right ſide, both of them diſperſed into his coate, that he might not be altogether like a plant without ſenſe, albeit ſeruing onely for nouriſhment it ſtoode in no need of any quick or notable ſenſe wherefore his Nerues are ſo very ſmall. Hence it is, that the paines of the Liuer are not acute or ſharpe, but obtuſe or dull, and grauatiue onely. But the bottome or center of the Liuer is altogether without ſenſe, becauſe of the many motions of the humors therein.

The Nerues of the Liuer.

The vſes of the Liuer.

The vſe of the Liuer is by his affuſed ſubſtance to part and ſeparate the veſſels that they cleaue not together; to ſuſtaine and eſtabliſh them; to cherriſh them with his heate, becauſe in that place their coats are thinner, ſayth *Galen* 4. *vſu partium*, 13. than in any other part of the creature. For by this helpe, ſanguification which is celebrated in the rootes of the gate veine, which are in the ſubſtance of the Liuer, is duly adminiſtred: to affoord vnto them the naturall Faculty as it were by irradiation, euen as the veſſels of ſeede receiue the faculty of Seed-making from the Teſticles; as alſo to procreate the Naturall ſpirite, which ſome deny but *Archangelus* by many arguments doth eſtabliſh: and laſt of all to preſerue and maintaine the Nouriſhing Soule as they call it, which is ſeated in euery particular part of the body.

Columbus.

But becauſe there are many opinions concerning the manner of ſanguification, I haue heere thought good to ſet downe *Bauhines* conceite, as the opinion of a man to whome I am eſpecially in this worke beholding.

The maner of ſanguification as *Bauhine* hath deſcribed it.

All Aliments aſwell ſolid as liquid are taken by the mouth and after maſtication or chewing as there is more or leſſe neede, are ſwallowed into the ſtomacke and there concocted and turned into Chylus. This Chylus, afterward when the *pylorus* or lower mouth of the ſtomacke is opened, is thruſt downe into the guts; and if any part of it eſcaped elaboration before, is there reuiſed and re-concocted. The thin and lawdable part of the Chylus (for the thicke excrements called *Aluinæ fæces*, are forced into the great guts) together with that humour which is as it were a watery excrement, and was engendred in the concoction of the ſtomacke, is ſuckt away by certaine branches of the Gate-vein deriued from his trunke (which is fixed in the hollow part of the Liuer) vnto the ſtomacke, but eſpecially vnto the guts. Theſe veynes which are called *Venæ Meſeraicæ*, and wee muſt call the Meſeraick veines, do attenuate the Chylus which they receyue, prepare it and giue it the fyrſt rudiment of blood, ſo that now it beginneth to be called *Chymus*, that is, a *Humour*: which when it approacheth to the trunke of the Gate-veine, is vnburdened of his thicke part, the Spleene drawing it away by the Spleenicke branch, as hath beene ſayde in the vſe of the Spleene.

When the Chylus becõmeth *Chymus.*

That which remaineth of this *Chymus* or *Humour*, is conueyed out of the trunke of the Gate-veyne into his rootes which are very many and very ſmall, diſperſed through the hollow part of the Liuer. Their coate alſo is very thin (as is alſo the coats of the veſſels of the Spleene, the Teſticles and the Paps) that the ſanguifying Faculty might more eaſily inſinuate it ſelf into them from the *Parenchyma* or fleſh of the Liuer, without which the blood cannot be made profitable for nouriſhment; and from which thoſe veſſels receiue by irradiation the ſanguifying Faculty, as the ſpermaticall do the Faculty of Seede-making from the Teſticles. In theſe veſſels therefore the *Humour* is changed into blood, for no Chylus is powred out of the roots of the Gate-veines into the fleſh of the Liuer.

Why there is no cauitie in the Liuer, but a web or net of veſſels.

Now that this *Humour* might be longer reteyned, and paſsing through many alterations be diuided into as ſmall portions as was poſsible, or rather be perfectly laboured, Nature ordained no ſuch cauity in this place as in the ſtomacke; but of infinite & ſlender branches of Veines made a texture-net or web wherein the Chylus is better thinned, mitigated and parted into ſmall portions, that the fleſh of the Liuer on euery ſide compaſsing his diſſeuered parts, might better worke it into a Maſſe of blood. For if there had beene a cauity formed in the Liuer, then muſt the Chylus haue had a Canel or pipe for his egreſſe and regreſſe through which it woulde haue falne away crude and not perfectly ſanguified, and therefore vnfit for the nouriſhment of the parts.

The naturall inſtinct of veſſels.

After the blood is thus abſolued and perfected in the roots of the Gate-veine, they haue a naturall inſtinct to part with it, partly to powre it into the fleſh of the Liuer for his nouriſhment that before did them ſo good an office; partly to vnloade their burthen into the rootes of the Hollow Veine, which are eſpecially diſſeminated through the Conuexe or gibbous and embowed part of the Liuer, which rootes alſo haue an inſtinct or deſire to draw it into themſelues, and to deliuer it ouer into their boughes and branches (in which it receyueth a farther degree of elaboration) pure and defæcated from all excrements, to be diſtributed vnto the parts of the body.

The rootes of the Hollow and Gate veines, although they be hand ouer head as we ſay, without any preciſe order diſtributed through the fleſh of the Liuer, yet in manie places they are ioyned by Anaſtomoſis or inocculation (excepting the branches which ſerue for the nouriſhment of the Liuer it ſelfe) as they touch in their paſſage ouerthwart one another,

ther, or elſe the extremities or endes of the gate veines are faſtned into the middeſt of the rootes of the hollow veine; or contrarily the ends of the hollow veines into the middeſt of the gate veines: for after no other manner but this, can the bloud be tranſlated out of the rootes of the gate veine into the rootes of the hollow veine. *Anaſtomoſis* how it commeth.

But that the bloud might better paſſe through the narrow and ſtraight paſſages of the veſſels, it is wefted by a thin and watery humour which is moſt like to whay; and therefore is called *ſerum ſanguinis*, we call it commonly the Vrine; a humour which is not fitte for the nouriſhment of any part, but onely mingling it ſelfe with the bloud, it maketh it more thin, and ſo readier to paſſe along: wherefore *Hippocrates* called it ὄχημα τῆς τροφῆς, *The Wagon of the Nouriſhment.* The vſe of the whay.

And whereas no Aliment is ſo ſimple, but that it conſiſteth of diuers and different parts; we muſt know, that all thoſe parts cannot be changed into laudable bloud; wherefore as in the firſt concoction celebrated in the ſtomacke and the ſmall guts, there was a ſegregation of the excrements of the belly: ſo in the beginning of the ſecond concoction, which was in the meſeraicke veines, there was a ſegregation made of the craſſe and fœculent part of the Chylus, from the pure and laudable, which was ſent away to the ſpleene. But in the concoction which is accompliſhed in the veines of the Liuer, two excrements are ſeparated, leaſt if they remayned mingled with the bloud, they ſhould be with it tranſported into the whole body. Theſe through their proper paſſages are conuayed and ſtored vp in peculiar and appropriated receptacles or places of receipt. The firſt of which, is the bilious or cholericke excrement, which is diſpoſed partly into the bladder of gall, partly ſent away into the gut, as we ſhall ſay in the next chapter. The ſecond is, the *ſerous* or whaey humor, the greateſt part whereof, when the bloud is ariued out of the rootes of the gate-veine into the hollow veine, becommeth an offenſiue burden vnto it; and therefore the Kidneyes by the emulgent veines and Arteries draw it out of the hollow veine and the great Arterie into themſelues.

The bloud thus cleanſed and depured from all manner of excrements, is diſtributed by the trunkes and branches of the hollow veine through the whole body, in which paſſage it receiueth an alteration or diſpoſition of nouriſhment, that no time ſhould bee loſt. Theſe branches of the hollow veine doe with the bloud carry alſo a part of the aboue mentioned whay or vrine, to make it more fluxible, that it might the better paſſe through the Capillarie veines of the parts to nouriſh them; where when it is ariued, it is as it were ſprinckled vpon the fleſh, into which by little and little in manner of a vapour or dewe it ſoaketh and ſinketh, cleauing like glew till it bee wholly conuerted into their proper Aliment; which glew by nouriſhing and reſtoring, maketh good the Radical moyſture and the ſubſtance of the parts. But the whay which accompanied the bloud thither in the third concoction, that is, in nouriſhment which is accompliſhed in euery particular part, as an vnprofitable excrement is exhaled in ſweat and inſenſible tranſpiration: thus far *Bauhine.*

Of the Bladder of Gall. CHAP. XIII.

THE Bladder of Gall [Table 15. Figure 1.2. [P P]] called *veſica biliaria*, or *folliculum felleum*, in greeke κύστις χολήδοχος, is the receptacle of pure choller; and hath his ſeate in the right and hollow part [Table 15. [BB]] of the Liuer, that it may be fitter to receiue the choller, which being a mad and hare-brain'd humour, had neede at the firſt generation of it be ſent away, leaſt it ſhould ſet all the body in an vprore; and therefore Nature placed his receptacle in the very boſome of the Liuer; his own acrimonie alſo haſtneth his euacuation. The Liuer therefore hath as it were engraued in it a certaine cauity or boſome, wherein the vpper and middle partes of the bladder are tyed firmly to it; the lower part in the meane time hanging looſe from the body of the Liuer, ſo as it toucheth the right ſide of the ſtomacke and the Colon, dieth them both oftetimes with a yellow colour; yea further affecteth them with his iuice ſweating through his coates; whence it is not vnlike, that the burnings and flaming heates of ſome mens ſtomacks doe ariſe. The Figure of it is [Table 15. Fig. 2.] long, that it might not bee preſſed by the ſtomacke, round alſo with his length and hollow, which hollowneſſe by degrees becommeth narrower, till at length it endeth in a necke. The ſcituation. The flaming heats of ſome mens ſtomacks whence it commeth. The figure.

It is ſmall in reſpect of the ſpleene and the Kidneyes, albeit it drawe a iuyce both of a middle quantity and conſiſtence in reſpect of the iuyces drawne by them both: but the reaſon Why ſo ſmall.

AA 1. A part of the Rimme of the belly, with the ribs is here turned back.
BB C 1. The hollow side of the Liuer.
D 1. A part of the gibbous side of the Liuer.
E 1. The fissure or cleste of the Liuer, made for the ingresse of the vmbilical veine.
FF 1. Certaine inæqualities in the hollow side of the Liuer neare the original of the gate veine.
G 1. A Ligament of the Liuer, tying his left side to the midriffe.
H 1. The bosom of the Liuer which giueth place to the stomacke.
I K 1. The stomacke thrust to the left side.
L 1. The left orifice of the stomacke, with the vessels which compasse it about.
M 1,2. The right orifice of the stomacke or the *Pylorus* ioyned to the *duodenum*.
N 2. The gut called *duodenum* ioyned to the *pylorus*.
O 1. A nerue inserted into the hollownes of the Liuer proceeding from those Nerues which compasse the mouth of the stomacke.
P 1,2. The bladder of gall
QQ 2. The holes of the bladder of gall dispersed through the Liuer, betwixt the rootes of the hollow and gate veines.
R S 2. The rootes of the gate and hollow veines in the Liuer, of the gate vein at R, of the hollow vein at S.

a 2. The concurse or meeting of the passages of choler into one branch
b 1,2. The necke of the bladder into which the passage is inserted
c 1.2. The passage of the gall into the *duodenum*.
d 2. The *Duodenum* opened, that you may see the insertion of the *porus biliarius*, or passage of choler.
e 2. An artery going to the hollow part of the Liuer, and the bladder of gal.
f 2. A small Nerue belonging to the Liuer and the Bladder of Gall, from the ribbe braunch of the sixt paire.
gg 2. The *Cysticke* twins from the gate veine.
ii 1. The *Pancreas* growing to the *duodenum*.
k l m 1. The *mesenterie*, but *k*. sheweth the distribution of the right trunk of the gate veine into the *mesenterie*.
m 1. A part of the *mesenterie*, to which is ioyned the right side of the collicke gut.
n 1. A veine going to the backe part of the right gut.
o 1. A part of the bottome of the bladder of vrine.
p 1. The right Kidney couered with a fat membrane
q 1. The right vreter from the kidney to the bladder.
r 1. The right spermatical veine and arterie.
s 1. Branches from the foresaid vessels to the *Peritonæum*.
t v. The vessel of seed called *deferens*, or the *Leading Vessell*.

Table xv. The first Figure sheweth the lower belly, wherein the stomacke with the guts are thrust into the left side: the Liuer is lift vp also, that you may better see the hollow side of the Liuer, the bottome of the bladder of gall, the vessels which passe thereunto, and the passage of gall called Porus biliarius, *which goeth vnto the duodenum, and certain branches beside of the gate veine, together with a part of the mesenterie. The second figure sheweth the bladder of gall, his passages and vessels, as commonly Anatomists make demonstration of them.*

FIG I.

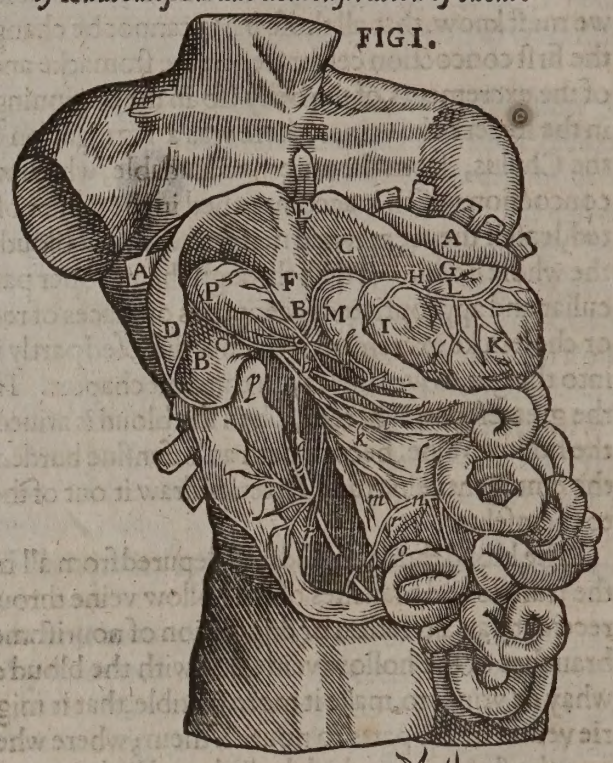
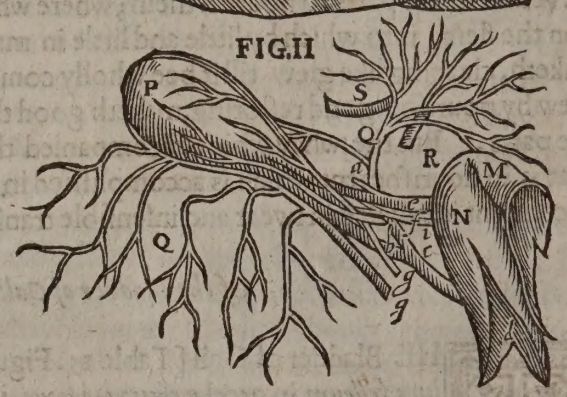


FIG II



son of his smalnes is, becauſe the number of his drawing orifices is both greater and more commodious then those of any other instrument whereby the Liuer is depurated or purged.

His substance

His substance is membranous, to the end that being full, it might be dilated or stretched, and when it is empty it might fall together againe. For it hath a double membrane; one

The membranes.

common from the *Peritonæum* (*Vesalius* sayth from the coate of the Liuer) wanting Fibres wherewith that part onely which hangeth off from the Liuer (which onely stands in neede of a defence) is cloathed; and with this coate it is tyed to the cauity or bosome of the Liuer. Another proper, thin indeede, but firme and strong and of such a nature that it is not to be hurt or offended by choller, by which other membranes are much affected. Wherefore though it be but single, yet the number is supplied by the strength and fastnes of it; for it hath all kindes of fibres, that the substance might be stronger and fitter for dilatation; the

The cruſt of the veſicle.

inmost are right, the outward transuerse, the middle oblique and those not many. It is within incompassed with a crusty substance ingendred of the excrements of the third concoction of the bladder it selfe, least it should be hurt by the acrimonie and sharpnes of the

choller

choler conteined therein.

His Veſſels are. Two ſlender Veines from the trunke of the Gate-vein, called *Cyſticæ gemellæ*, the twins of the bladder [Tab.xv: fig:2 ss. Table xvi. fig.1 PP] which (as in the vvhite coate of the eye) are diſtributed for his nouriſhment. For it is nouriſhed as all other parts of the body with blood not with choler: and by other veſſels [table xv, fig:2. qq. Table xvi fig,1, DD. figure 2 aaa] draweth his proper excrement pure and vnmixed, ſaith *Galen* 5. *vſu part.*7. blended with blood, as do the Kidneyes. The veſſelles. The twin-veines.

The Arteries it hath are very ſmall, from the Cœliacall Artery which aſcend [Table xv.fig: 2 c. Tab.xvi, figure 1 N] vnto the hollowneſſe of the Liuer, that beeing (as it were) wrought by their continuall motion, it might be kept from corrupting. Arteries.

A Nerue it hath, but ſcarſe conſpicuous or viſible [Tab:xv, figure 2 f Tab,xvi, figure 1, o] from a little branch of the ſixt paire, that creepeth ouer the coate of the Liuer. All theſe veſſels are faſtned in the ſame place at the neck [Tab:xv, fig: 2 b, table xvi, figure 1, C] to the body of the bladder, and diſperſed into his coate do reach vnto his bottome, [Tab. xv, fig: 2 r. table xvi, figure i, A] Nerues.

A 1. The bottome of the bladder of Gall, in his naturall ſcituation.

B 1. *A* boſome or denne at the beginning of the necke of the bladder, at which place within are the values placed.

C 1. The necke of the bladder of gall.

DDD D. The holes or paſſages of the bladder of gal diſtributed through the ſubſtance of the Liuer between the roots of the Gate-veine at F. & the Hollow veine at G.

E 1. The meeting of the paſſages aforenamed.

FG 1. The roots of the gate-veine at F. the rootes of the hollow veine at G. al diſtributed through the Liuer.

H 1. The *Porus Biliarius*, whoſe mouth made of the concourſe of the paſſages marked before with DDD. is wider then the necke of the bladder.

II A common paſſage or hole (aſwell of the *Porus Biliarius* H. as alſo of the necke of the bladder C.) reaching to the gut *duodenum*.

K 1. The right orifice of the ſtomacke ioyned to the gut.

LM 1. The gut *duodenum* opened, that the inſertiõ of the forenamed common paſſage at M. might appeare.

N 1. An artery diſperſed into the hollowe part of the Liuer, and into the bladder of gall.

O 1. *A* ſmall nerue common to the Liuer and his bladder proceeding out of the ſixt pair: the cutter hath made it a little too big.

PP. 1. The veines called *Cyſticæ gemellæ*, or the twin veines of the bladder of gall, which are braunches of the gate-veine deriued to the bladder; They ſhould haue beene made much leſſe.

qq 2. The hollow part of the Liuer.

r 2. The bottome of the bladder opened.

ſ 2. The outſide of the bladder of gall.

t 2. The boſome or denne proper to the veſicle or blader of gal.

u 2. The neck of the bladder

x 2. Three values at the neeke, ſometimes but two.

yy 2. The *porus biliarius* open, which carrieth the thicker choler directly from the Liuer, to the end of the gut *duodenum*.

Z 2. The meeting of the necke of the bladder, and of the *Porus biliarius* into one.

aaa 2. Certaine ſmall paſſages out of the bottome of the bladder, carying the thinner part of the Choler into the Liuer.

The firſt Figure ſheweth the Naturall ſcituation of the bladder of Gall taken out of the Liuer, his faſhion and veſſels.

The ſecond Figure ſheweth the bladder of Gall growing to the Liuer, but opened, that you may ſee his values: it alſo ſheweth the Porus biliarius, *which paſſeth from the Liuer to the* Duodenum.

TABVLA XVI.

FIG. I

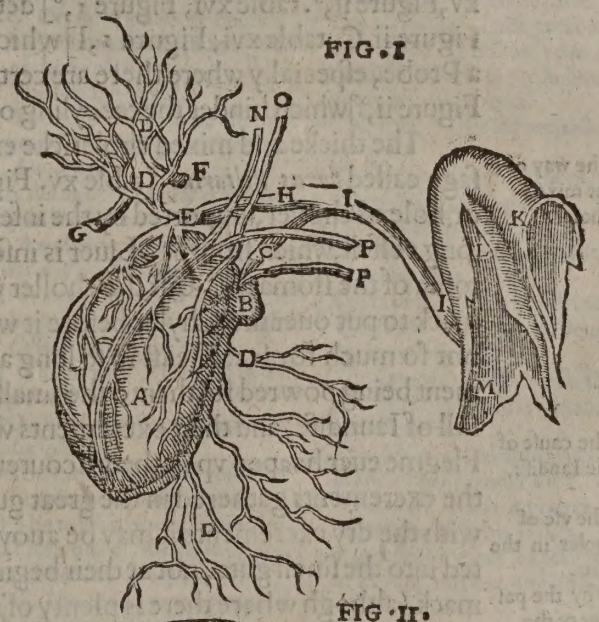
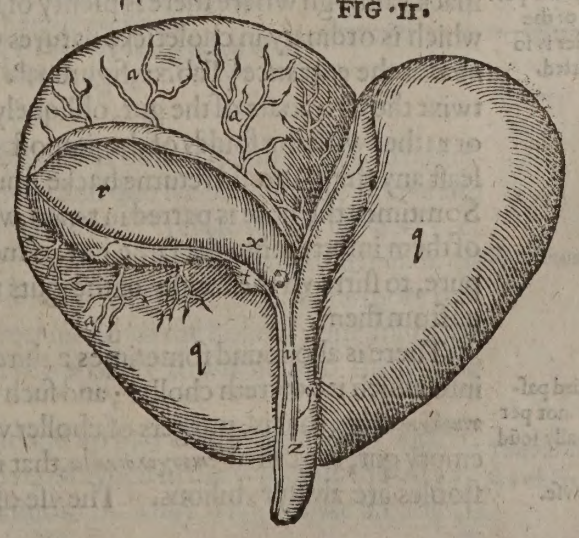


FIG. II.



It is diuided into a bottome, a necke, and the paſſages of choler, which are called *Meatus* or *pori Bilarij*. The bottome is the greateſt [Tab: xv. fig: 1, 2. [r]. Table xvi: fig. i, [A]] patt of the bladder, and looketh downward [as appeareth table xvi, fig: i] when with the Liuer it remaineth in his naturall ſeate. It is round, and dyed with the colour of the yellow choler it containeth; ſometimes it is blacke, when the choler being long kept in the place is aduſt or burnt, which alſo now and then is condenſed or hardned into ſmooth ſtones of diuers formes, which ſtopping the lower paſſages, wee haue knowne to breede perpetuall Iaundiſes and incureable.

The necke. The necke is the narrower part [Table xvi. figure 2, [b]] of the bladder, much harder then the bottome, to whoſe end is ſet a peculiar boſome or cauity. [Table xvi. figure i, [b]. figure 2, [t]]

The figure. It is alſo long, looking vpward, and by degrees ending in a narrow paſſage [Table xvi. figure 1, C] which making a ſemi-circular Figure, as of a halfe Moone, determineth into the paſſage of choler, called *Porus* [table xvi. Fig: 1, [n]] *Biliarius*, where the common paſſage is made [Table xvi, Figure 1, I]

The paſſages of it. The paſſages of the bladder of Gall are double (called πόροι χοληδόχοι, becauſe they carry choler) for that the cholericke excrement is two wayes purged out of the Liuer, to wit, pure and vnmingled, or mingled and thicke according to *Galen*, 4 *vſu part.* 12, and 13. For the vnmingled and pure choler is drawne by ſmall veſſels [Table xv. Figure ii, [qq]. tab. xvi. Figure 1, [ppp], Figure ii, [aaa]] ſent into the Liuer [Table xvi, Figure ii] with infinite ſtrings: ſhed abroad between the roots of the hollow [table xv, Figure ii, S. Table xvi, [L]] and Gate-veines, [table xv. Fig: ii, [R]. table xvi. Figure 1, [E]] and at length ioyned together into one [tab: xv, Figure ii, [b a]. table xvi. Figure 1, [E]] paſſage, and thence powred into the Bladder, and ſo it is continually filled and as continually emptied (the Bladder being preſſed as ſome ſay in thoſe creatures that go vpright by the Liuer, in others by the ſtomack) by a paſſage [tab xv, Figure ii, [b]. table xvi, Figure 1, [c]] determining into the pore or hole of choler, [table xv, Figure ii, C. table xvi, Figure 1, I] which is very fine and threddy, that it will ſcarſe admit a Probe, eſpecially where there are certaine ſmall Membranes about the necke [table xvi, Figure ii, [x]] which hinder the recoyling or regurgitation of the choler.

The way of the pure choler.

The way of the mixed choler. The thicke and mixed cholericke excrement is drawn from the Liuer by another paſſage called *porus Biliarius* [table xv. Figure 1, 2. [c]. table xvi. Fig. 1. [H] Fig. 2, [yx]] the pore or hole of choller, ſupported by the inferior membrane of the *omentum* or Kall. This is a long veſſell, which from the Liuer is inſerted in a circular or round figure, not into the bottome of the ſtomacke, leaſt the choller with his biting ſharpneſſe, ſhould prouoke the ſtomack to put ouer the Chylus before it were concocted; nor into the ſeat or place of ſeidge, not ſo much for feare leaſt in ſo long a paſſage it ſhould be broke; as becauſe this excrement being powred forth into the ſmall guts (for this paſſage being ſtopped men become full of Iaundiſe, and their excrements white) attenuateth and cutteth a great quantitie of Flegme euer heaped vp in them, ſcoureth their inward ſuperficies, and being mingled with the excrements gathered in the great guts, doth prouoke thē to excretion, that ſo together with the dry excrements it may be auoyded by the ſtoole. But this pore of choler is inſerted into the ſmall guts, not at their beginning, leaſt the Choler ſhould flye vp into the ſtomack (althogh where there is plenty of it it vſeth to regurgitate or recoyle to the ſtomack, which is ordinary in cholericke natures when they faſt long) but into the end of the *Duodenum* at the entrance [Tab. xv, figure 2, [p]. Table xvi, fig. 1 [M]] of the *Ieiunum* or emptie gut betwixt the two coats of the gut, obliquely, the orifice being couered with looſe membranes or rather with the foulds of the inmoſt coate ſtraightly ioyned and cloſing vp the paſſage leaſt any thing ſhould returne backe, much like the paſſage of the water into the bladder. Sometimes the pore is parted in twain, with a ſmal diſtance betweene the partitions & both of them inſerted into the ſame gut. And it carrieth mingled choler together vvith more pure, to ſtirre vp the faculty of the guts to auoyde the excrement after the Chylus is ſucked from them.

The cauſe of the Iandiſe.

The vſe of choler in the guts.

Why the paſſage of the choler is ſo inſerted.

There is alſo found ſometimes a third paſſage, inſerted into the bottom of the ſtomack, into which it powreth choller; and ſuch men doe continually vomit choller, and are called πικρόχολοι ἄνω, that is, purgers of choller vpward, as thoſe men who haue it at the end of the empty gut, are called πικροχολοι κάτω, that is, purgers of choller downward, and theſe men to ſtooles are alwayes bilious. The vſe of this bladder of gall is to receiue and expel yellow choler

A third paſſage not perpetually foūd.

The vſe.

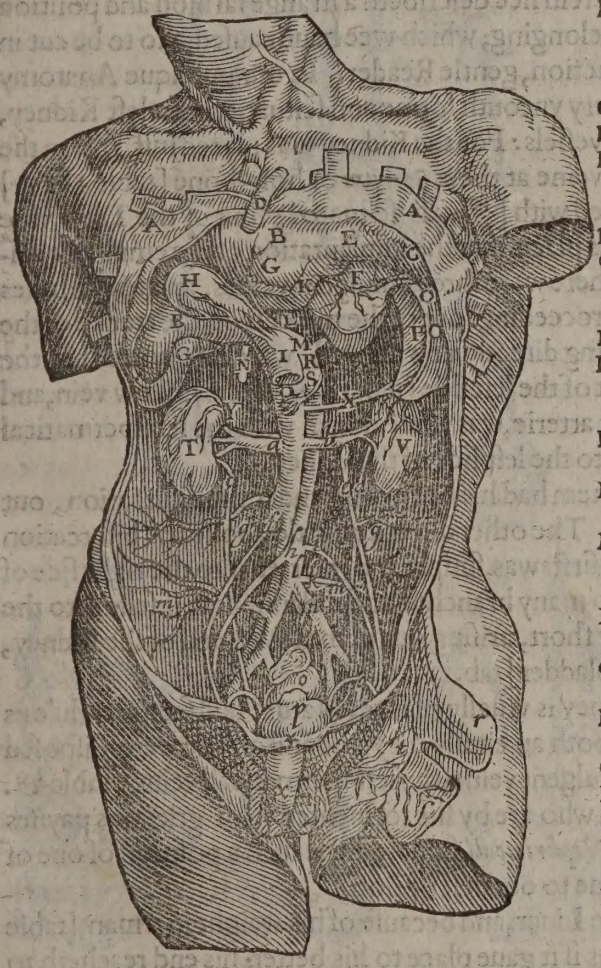
choller exactly ſincere vnmixt and familiar vnto it ſelfe immediately from the Liuer and ſo out of the whole body, which otherwiſe running at randon through all, would defile the ſpirits, raiſe a continuall vlcerous ſence his acrimony gnawing the fleſh and rending the membranes, cauſe all our motions to be head-ſtrong and giddy, our ſenſations phrenetick and mad; and beſide diuerſe other inconueniences would breed a continual Iaundiſe.

Of the Kidneyes. CHAP. XIIII.

THE Kidneyes are called *Renes* of a word which ſignifieth to flow, becauſe the vrine flowes away by them; and *νεφροὶ*, as it were Piſſers. All men and foure-footed beaſtes which beget by generation haue them, but no fowle or fiſh with ſcales, ſaue onely the Tortoyſe, ſaith *Ariſtotle* in his fourth book *de partibus animalium*; for their humour is ſpent into ſcales and feathers, and beſide The names.

The lower Belly emptied of the Membranes, Guttes, and Stomacke, together with many of the veſſelles which are therein.

TABVLA. XVII.



A A The midriffe turned backe with the ribs & the *Peritonæum*.
B B The caue or hollow part of the Liuer, for the liuer is lifted vppe, that the hollow part of it may be better ſeene.
C The left ligament of the liuer.
D The vmbilicall veine.
E The hollownеſſe in the Liuer, which giueth way to the ſtomacke.
F The left orifice of the ſtomack.
GG Certaine knubs or knots & impreſſions in the hollow part of the Liuer.
H The bladder of gal.
I The gate veine cutte off, and branches which go to the bladder of gall.
K A nerue of the Liuer comming from the ſtomachical nerue.
L An artery common to the Liuer and the bladder of gall.
M A nerue common alſo to thē both, comming from the right *Coſtal* nerue of the ribs.
N The paſſage of the gall to the guts cut off
OO The hollow and forepart of the ſpleene.
P The Line where the veſſels of the ſpleene are implanted.
Q The trunk of the hollow veine
R The trunk of the great artery.
S The *Cœliacal* artery cut off.
T V The Kidneyes yet wrapped in their membrane.
X Y The fatty veines called *venæ adipoſæ*.
a b The emulgent veines togither with the arteries vnder th m.
c c d d The vreter from either kidney to the bladder.
e f The ſpermaticall veines to the Teſticles, the right from the hol low veine, the left from the emulgent.
g g Veines comming frō the ſpermaticall veines to the *Peritonæū*.
h i The ſpermaticall arteries.
k The lower meſentericall artery.
l The aſcending of the great artery aboue the hollow veine, & the diuiſion of it & the hollowe veine into two trunks.
m The artery of the loynes, called *Lumbaris*.
n The holy artery called *ſacra*.
o A part of the right gut.
p The bladder of vrine.
* The connexion of the bladder, with the *Peritonæum*.
q A part of the veſſels which lead the ſeede from the teſticles, is here reflected.
r ſ The *ſcrotum* or codde, that is the skin which inueſteth the yarde and the teſticles.
t The fleſhy pannicle or membrane which is vnder the Cod.
u The coate which is proper to the teſticle with his veſſels.
x A part of the yarde excoriated or flayed, and hanging downe

they drinke little becauſe their longues are not ſo bloudy as other creatures are. The kidneyes haue ſeldome the ſame ſcite or poſition in men; and doe lye behinde the guttes and the ſtomacke, a little vnder the Liuer and Spleene [table 17. °°] cloſe vppon the backe, at the ſides of the hollow veine and the great Arterie [Table 17. ᵠ ᴿ] yet not in an equall di- The ſituatiō.
ſtance (hauing their hollow partes turned toward one another) that they might more readily draw away the whay, that all the bloud that is receiued into the hollow veine, might be preſently purged and ſo carried pure, with a little water onely to weft it, into the whole body.

For this watery humour, albe it be an excrement and no part can be nouriſhed with it, The vſe of
yet is it very neceſſary as long as the nouriſhment is contayned in the veines of the meſen- the whay.
tery and the Liuer, that by the thinneſſe of this humour or whay being made fluxible, it

might

might passe those straight veines, whereupon *Hippocrates* calleth it *vehiculum alimenti*, or the wester of the nourishment, as before is sayd. But when the bloud is gotten into the hollow veine, it then needeth not so much helpe, because it is to passe through large and patent passages, and beside is made of it selfe more fluxible by the heat of the heart and the Liuer.

Why placed one aboue another.

They often stand not one opposite to the other [table xx. and table 2. *lib.* 4.] least in their ioynt strife they should hinder one the others attraction, as *Galen* hath conceiued; but wee, sayeth *Bauhine*, imagine that the cause of this position is rather to bee attributed to the arising of the vessells [Table xx.^{h}] and properly of the emulgent or sucking veines, because their attraction is greater and of more vse.

Their position.

They lye with their flat sides vppon the muscles of the loynes which they call ψόας, appointed for the bending of the leg; about their heads not much lower then the lowest ribs, in those voyde spaces which are betwixt the rootes of the ribs and the hip-bones. They lie betweene the two membranes of the *Peritonæum*, one of which lyeth vnder them, the other vpon them; whence it is that in fits of the stone, the legge on that side where the stone lyeth is benummed, sayeth *Hippocrates*, because of the compression as well of the muscle we spake of before, as of a sinew which descendeth that way.

An vncouth forme of the kidneyes obserued by *Bauhine. An.* 1589.

But before we proceede further in the particular description of the Kidneyes, giue mee leaue to insert a story out of *Bauhine*, wherein hee describeth a strange fashion and position of a Kidney, with all the vessels thereto belonging; which wee haue caused also to be cut in the following Table for thy better satisfaction, gentle Reader. In our publique Anatomy sayth he, *Anno Dom.* 1589. we found a very vncouth forme and scituation of a left Kidney, as also of the emulgent and spermaticall vessels: For the Kidney was placed iust vppon the diuision of the great Artery and hollow veine at the *os Sacrum* or holy-bone [table 18.$^{d\,e}$] in that cauity wherein the bladder marked with [^{f}] was scituated; but in the Table wee haue remoued the Kidney a little from his place, that the implantation of the emulgent vessels might better be demonstrated: for there were three emulgent veines, and two arteries fastned into it. Two of these veines proceeding out of the middest of the trunke of the hollow vein [table 18. 6. 6.] and descending directly downeward, were implanted into the right side. The third emulgent arising out of the left side [tab. 18. 9.] of the hollow vein, and descending vnder the trunke of the great arterie, was a litle mixed with the left spermatical veine [table 18. 16.] and after inserted into the left side of the kidney.

As for the emulgent Arteries, one of them had his beginning vnder the bifurcation, out of the right Iliacall branch [table 18. 7.] The other did arise a little aboue the bifurcation out of the great artery; [table 18. 8.] the first was simple and inserted into the right side of the Kidney; the second was diuided into many branches and did insinuate it selfe into the left side. So also the left vreter was very short, arising out of the lower end of the Kidney, [table 18. 19.] and was inserted into the bladder [tab. 18. 20.]

Finally, in that place where the left Kidney is vsually placed, Nature had set a glandulous and fat substance [table 18.^{c}] to which both an emulgent veine and arterie were disposed [table 18. 4. 5.] as also from the vpper emulgent veine, the left spermaticall veine [table 18. 4.] did arise. It may be that those men who are by fits tormented with grieuous paynes about the Holy-bone, and haue all the *Nephriticall* signes, haue such a position of one of their kidneyes as this was: now we returne to our description.

The seate of the right kidney.

The right Kidney lyeth iust vnder the Liuer, and because of his waight in a man [table xviii.] it is lower then the other Kidney, as if it gaue place to his better; his end reacheth to the third racke-bone of the loynes. It is very rarely higher then the left, and then onely when it is shorter, or when the part of the Liuer lying next it, is hollowed: they are also rarely of an equall height, because of the different position and quantity of the Liuer and Spleene; some also adde because of the higher or lower beginning of the emulgent vessells.

Of the left.

On the left side, the Kidney lyeth vnder the Spleen, and is often (yet not alwayes) higher then the other, because there the Spleen is thin and slender; so that the Kidney ascendeth sometimes to the first racke-bone of the loynes, sometimes to the xi. of the breast; yet neuer is one so farre aboue the other, that the middle of the higher doth reach aboue the top of the lower. But in bruite beasts because of their groueling gate, and because their spleen reacheth further downeward the scituation of the Kidneyes is contrary; so that in Dogges there is a hollownesse or bosome made in the Liuer (which in a man hath neyther hollow-

nes

The first Figure sheweth the disport of Nature in the seminary vessels, the emulgents, and the position of the left Kidney, as wee met with it in a publicke Dissection.

The second Figure sheweth the seminary vesselles, with the Testicles.

The third Figure sheweth the diuers formes of the Testicles, and their seuerall parts.

TABVLA. XVIII.

FIG. I.

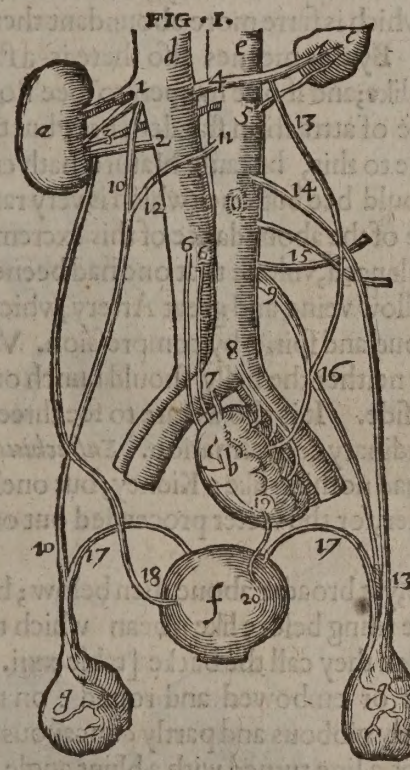
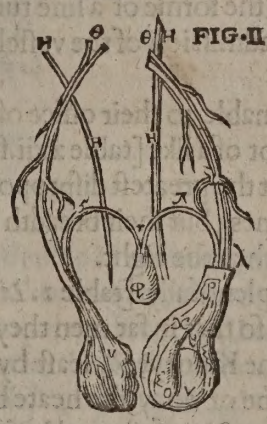


FIG. III.

FIG. II.



a b. The right kidney *a.* the left *b,*

c A glandulous and fatty substance, which was in the roome of the left kidney.

d e. The hollow veine *d.* the great artery *e.*

f The bladder of vrine.

g g. The testicles.

1,2. A double right emulgent veine, the first of which hath a double originall.

3. The right emulgent artery.

4. The left emulgent veine.

5 The left emulgent artery.

6,6 Two emulgent veines at the left kidney.

7,8 The emulgent arteries vnder the bifurcation or diuision at the left kidney.

9 The fourth left emulgent veine.

10,10. The right spermaticke veine.

11,12. The originall of the spermaticke arterie 11. his coniunction with the vein 12.

13 The left spermaticke veine.

14 The left spermaticke artery.

15 A veine going from the left spermatick veine to the *Peritonæum*, acompanied with an artery.

16 The vnion of the left spermatick veine, with the emulgent veine. 17 The leading vessels

18 The insertion of the right *Vreter.*

19,20. The originall of the left *Vreter* at 19. and his implantation at 20.

Figure. 2. xxxx The *Vreters.*

θ θ The spermaticke veines and arteries.

11 The coate of the testicle which ariseth from the *Peritonæum.*

λ The spermatical veine and artery, as they passe into the production of the *Peritonæum*, and as they passe againe out of it.

μ The bodden body called *corpus varicosũ*, or the wonderfull implication of the veine and artery

ν The left testicle couered with the inmost coat.

ξ ξ The reuolution of the leading vessels.

ο ρ The ascent of the leading vessell vnto the share bone.

π ς The reflection or returning of the leading vessels to the backe side of the share bones.

τ φ The coition or meeting togither, and insertion of those vesselles into the Glandules called *Prostatæ* at φ.

Figure 3. A B The forepart of the right testicle.

C C D The spermaticke veine and artetie cut off where they fall out of the *Peritonæum*, and C sheweth the beginning of the bodden body, called *Corpus varicosum*, and D sheweth his *basis* or foundation.

E The passage of the leading vessel.

F His reflexion. G, A portion of the leading vessel climbing vpward, with his departure from the testicle. H, The porous or spongy face of the leading vessel or *Epididymis*, wher it groweth to the coat of the testicle. I, the gibbous or round part of the same vessell, where it groweth not vnto the foresaide coate. L, the forepart of the testicle. M, the backe part of the same, together with his inmost coate, & the bodden body. N N, the first commixtion of the spermaticke vessels. OO, the *basis* of the spiry bodden body and his insertion into the inmost coate of the testicle. P, the testicle couered with his inmost coate, shewing the vpper part into which the bodden or varicous body was inserted. Q R S, the inmost coate of the testicle, drawne from the testicle at R. but couering the testicle at S. T, the testicle cut through the middest. *V V*, the distribution of the vessels through his substance.

nesse nor diuision) that the right Kidney might ascend higher. Indeede the true causes of their diuerse situation, are the different magnitude of the kidneyes, the different length of the vessels, and their position either more or lesse oblique. They are knit by the help of an externall Membrane arising from the Rim (which like a Ligament stayeth them firme-

The true causes of their diuers position.

Their connexion.

ly

ly in their proper places) to the loyns, the *Diaphragma*, and the right to the blind gut, ſomtimes to the Liuer; the left to the Colon (whence it is that nephriticall paynes, that is, inflamations or other paynes of the Kidneyes become more grieuous by reaſon of aboundance of wind or excrements, & the collicke is often hardly diſtinguiſhed from the paines of the Kidneyes) and to the ſpleene.

Their fibres. Beſide the membrane aboue named, they haue alſo other fibres from the *Peritonæum* inſerted into their gibbous part, which are happely thoſe *Hippocrates* calleth Nerues, in his booke *de natura oſsium*. They are alſo tyed by the emulgent veſſels to the hollow veine and the great Arterie [table 1^m.^a b, tab. 2. *Lib.* 4.^m n, table 22.^h i.] Finally to the bladder it ſelfe by the vreters or paſſages of vrine, of which wee ſhall heare more by and by [table xvii.^p c d, table xxii.^m n e.]

Why two. The Kidneyes are two, becauſe one would not haue beene ſufficient for the euacuating of ſo great a quantity of wateriſh excrement, which is farre more aboundant then both the excrementitious chollers, yellow and blacke. By this meanes alſo there is a ſtronger attraction of ſerous bloud, and both ſides draw alike; and if one happen to bee ſtopped with the ſtone or grauell or ought elſe, yet the worke of attraction ſtandeth not, but the vrine is auoyded; (although *Archangelus* will not yeelde to this, becauſe Nature hath created nothing againſt caſualties;) whereas if there ſhould bee but one (which is very rare) it muſt haue beene of neceſsity as big as both, becauſe of the aboundance of this excrement, and ſo the body ſhould not haue beene equally ballanced, vnleſſe that one had beene ſeated in the very middeſt of the backe, iuſt vpon the hollow veine and great Artery, which ſcituation would haue hindered the free deſcent of bloud and ſpirits by compreſsion. Wherefore Nature for one greater made two ſmaller, that neither the belly ſhould bunch out, or the creature incline and hang too much to either ſide. It is alſo as rare to ſee three or foure, which when it hapneth they keepe not their ordinary conformation. *Euſtachius* obſerued three together, the right was naturall, the left had nothing like a Kidney, but onely the ſubſtance of a triangular form, and wanting an vreter, for the vreter proceeded out of the third which was almoſt foure ſquare.

One would haue ouerwayed on one ſide.

The figure. The Figure of the Kidney is long and broad, yet broader aboue then below; before and behinde preſſed ſomewhat flat, yet a little more riſing before like a bean which therevpon we call a Kidney beane. On the outſide (which they call the backe [table xxii. figure 1. ^c.] of the Kidney) towarde the flankes gibbous or embowed and round: on the inſide where they looke toward the hollow veine, partly gibbous and partly concauous; flatte or ſadled, and as it were crooked into the forme of a line turned with a blunt angle, for ſuch muſt it of neceſsity be, both for the admiſsion of the veſſels, and for the forming of the hollownes or cauities therein.

The magnitude of the kidneys. Their magnitude is proportionable to their office of purging the whaeye humor, although for the moſt part they are not of a like [table xxii. figure 1.] bigneſſe, nor their proportion anſwerable to the body; yet the greateſt diſproportion is in their longitude, which commonly equalleth foure rack-bones; but their breadth for the moſt part is but of three fingers, and the left is often ſhorter then the right.

The fat of the kidneys. About the kidneyes cleaueth fat plentifully [table 2. *Lib.* 4, °°pp] becauſe it hath peculiar veſſels by which it is nouriſhed; ſo that in fat men they are almoſt all couered: the vſe of which is to cheriſh the heate of the Kidneyes, leaſt by reaſon of the continuall diſtillation of ſo great quantity of the vrine or whay, the heate by degrees languiſhing might at length be extinguiſhed, & ſo al their action faile; and beſide, leaſt the veſſels ſhould be endangered by diſtention; wherefore in a man it is on the inner ſide of the Kidney layde as a ſoft bed or couch between the membrane compaſsing about the diſtribution of the veſſels and the braunches of the vreters: in a Dogge betwixt the membrane which formeth the ſaddle ſide of the Kidney; beſides, this fat with his ſmooth and ſlippery moyſture dulleth the acrimony of the whay or vrine.

The vſe of it.

The glandule of the kidney. There cleaueth to both the Kidneyes in the vpper part, where it regardeth the hollow veine, a glandule or kernell, the inuention or finding whereof is due to *Euſtachius*, which ſticketh faſt to their outward membranes, ſo that oftentimes if a man take not heede in the taking out of the Kidneyes, he ſhall leaue it hanging to the membrane of the *Diaphragma*. This glandule ſomewhat anſwereth in ſubſtance and figure to the Kidneyes themſelues, yet is often more flat and liker to a cake then to a kidney; as long it is as two fingers, as broad as one, of a moderate thickneſſe; but they are not alwayes of an equall greatnes, but moſt com-

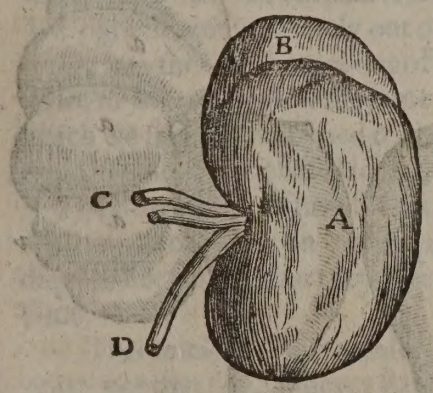
commonly the right is the larger. Among the new writers (ſome ſay) there are manie of them, but will not haue them to be found in euery body, but to bee engendred when the matter is too plentifull; but howſoeuer we haue the things, yet hitherto we want their vſe, or at leaſt the knowledge thereof. The vſe of theſe Glandules not yet knowne.

To this Glandule there is ſometime ſent a certaine Tendril from the hollow vein neere the Liuer, ſometimes it taketh it from the Veine which we call *Adiposa*, which goeth to the fat of the Kidneyes to nouriſh it, of which wee ſpake euen now: ſometimes it hath both Veines.

Table xix. ſheweth the Kidney of a man. The firſt figure the whole Kidney, with the Glandule ſet aboue it. The ſecond Figure ſheweth the Kidney Diſſected, that you may ſee the inward face of it.

TABVLA XIX.

FIG. I



A 1. The Kidney of a man whole.

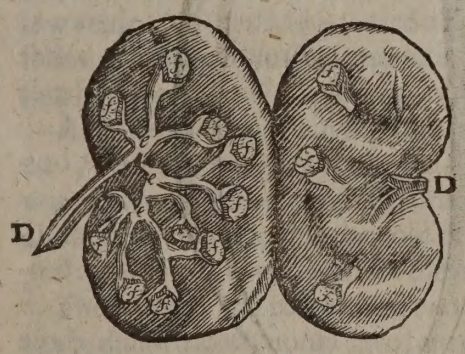
B 1, The Glandule placed vpon the Kidney.

C 1, The emulgent veine and Artery.

D 1,2. The Vreter.

eee 2. The Vreter open, and howe it parteth it ſelfe into the ſubſtance of the Kidneyes, as it were with many pipes.

FIG. II.



fff 2. Caruncles or teats, with very fine perforations, which opening into the foreſaide pipes of the Vreters, doe as it were through a fine ſtrainer paſſe the Vrine into them, to bee conueyed to the bladder.

The Kidnies are couered with a double Membrane, one outward, ariſing from the *Peritonæum* neere the lower part of the *Diaphragma*, where it is knit vnto the *Peritonæum*: this cleaueth not very ſtraightly to them [tab. 2, lib. 4. oo, pp] but they are as it were wrapped in it, whence it is called *fascia renum*, that is, the Kidneyes ſwathing band. This Membrane receyueth the *vena adiposa*, [table xvii, xy, table 2, lib. 4, 1h] and is rowled in plentifull fat, & ſo ſerueth the Kidneyes inſtead of a couering, of a tye, and of a ſoft pillow or bolſter. The Membranes.

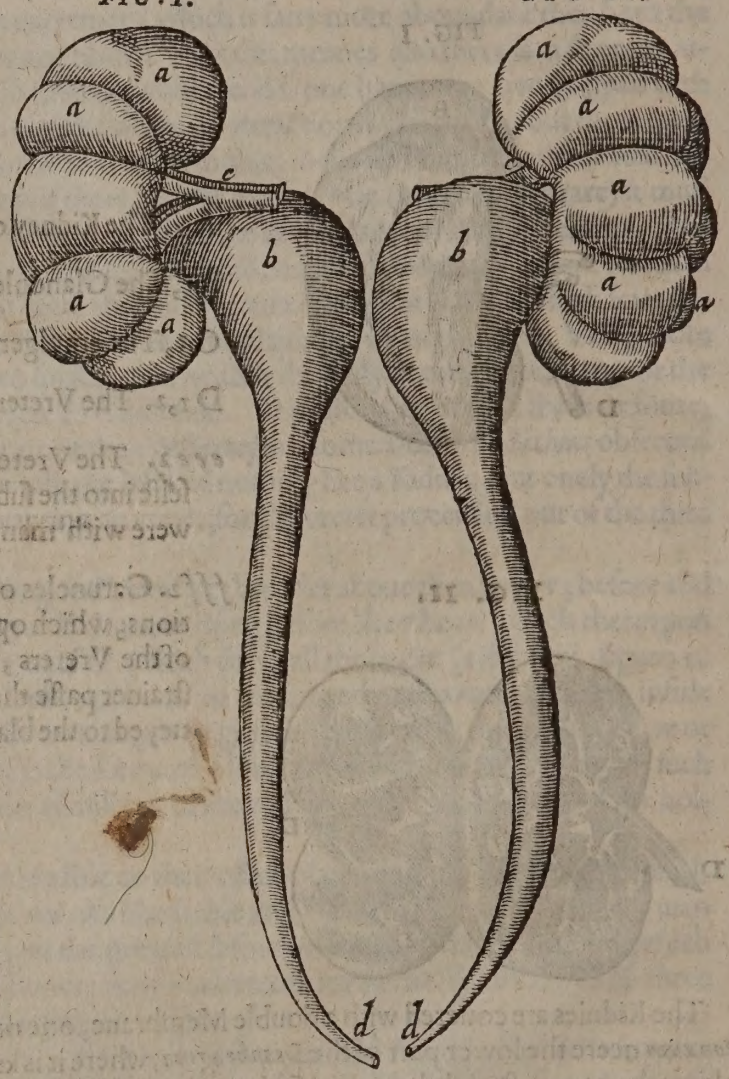
The other Membrane which is proper to the Kidnies is very thin, and produced out of the common coate that cõpaſſeth the veſſels (but dilated) and growes to them exceeding ſtrongly, ſo that it maketh their fleſh otherwiſe of it ſelfe firme, yet more faſt and compact. And although it make the outſide glib and ſhining yet it wanteth fat, neyther is it wouen with any veſſels. This accompanieth the veſſels, bent inward pierceth into their hollowneſſe and compaſsing them round about, makes them more ſtrong.

The ſubſtance of the Kidnies [table xxi, figure 2] is a hard fleſh moſt like the heart, ſauing that it wanteth fibres, which yet the threds of the veines do ſupply. Faſt and compact that the inherent heate may more ſtrongly and eaſily draw that which was ſo neere (for to draw an excrement from farre, a looſe and laxe inſtrument is more meete) and expell it; and againe, leaſt the blood which is their nouriſhment ſhould ſlippe away with the vrine, which would come to paſſe if their fleſh had beene immoderately looſe, whereas now it is fitly Their ſubſtance.

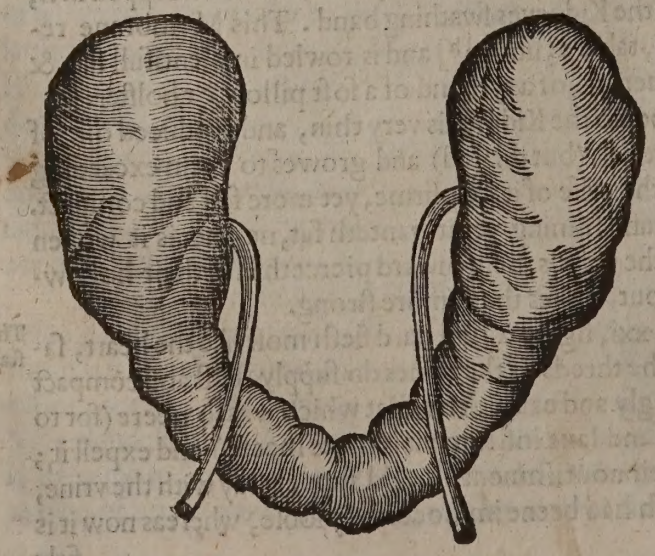
fitly reteyned, and hath time to bee diffuſed all ouer their ſubſtance. But on eyther ſide at the hollowneſſe [Tab.xxii.ee] where the emulgent veſſels are diuided into greater braunches, their ſubſtance is but looſe and vnequall, and is on the inſide perforated with paſſages running through it from the Nerues, where are obſerued certaine partes riſing ſomewhat from the fleſh, which in their ſubſtance, figure, and office do imitate the nature of glandules or kernels, whence ſome of the ancients haue eſteemed theſe parts of the kidneyes to bee Glandules. Without, his ſuperficies or face is like the Liuer ſmooth and glib: his colour duskiſh in a mans health, and not much vnlike a red Beane, ſeldome very red and ſhining. It is alſo very rare that a mans kindnies ſhould be outwardly vnequal, and made as it were of many kidnies or ſmall glandules like the Liuer of a Beare or Oxe, yet *Euſtathius* found

TABVLA XXI.

Fig.1.ſheweth the foreſide of the right Kidney. Fig.2.ſheweth the backſide.
a The body of the Kidney, conſiſting of eight lobes or partitions.
b The Vreter diſtended with Vrine.
c The emulgent veſſels.
d The lower part of the Vreter, far narrower then it vſeth to be.



This Table ſheweth the figure of a Childs Kidney, which died the fourth day after it was borne, in the Hoſpitall of *Argentine*. The child was opened by Doctor *Iohannes Rodulphus Saltzmanus*. He did indeede ſucke, but auoided nothing either by ſtoole or Vrine. His guts were full of wind, but his Fundament was not perforated. His kidneys were by lines diſtinguiſhed into eight parts. His vreters wel ſtretched with water, but at the bladder they were ſo ſmal, that a ſmal probe could hardly without violence be entred into them, which being ſtuffed with ſlime, did ſtop the deſcent of the Vrine, ſo that in the bladder, there was nothing but a little of that ſlime: the kidnies were ſomewhat like the kidnies of an Ox.



It ſhall not be impertinent alſo, to annexe this ſtrange forme of the kidnies which *Bauhine* receiued from that excellent Philoſopher and Phyſitian, D. *Leonard Doldius*, the ordinary Phyſitian of the Citty of *Norinberge*. This kinde of Kidnies and Vreters was obſerued in the body of *Andrew Helme* of *Weiſsenfield*, who dyed at *Norinberge*, the 17. of October, in the yeare of our Redemption, 1602. and the ſixteenth of his life, hauing lyen long hurt of a blow he receyued in his belly aboue the groyne.

ſuch

ſuch in two Infants, a Maide of a xi. yeares of age, and a Man at *Rome*. The forme of a kidney of that kind diſcouered in a young Childe by Doctor *Saltzmanus*, and by him ſent vnto *Bauhine*, we haue here a little before annexed.

The cauities of the kidneis.

They haue two *venters* or cauities, the outward and inward: the outward improperly ſo called [table xxii. [d]] which *Fallopius* calleth the Gate, is in the ſaddle ſide, where the kidney being like a bent bow returned at either end, it is moſt what diuided into three partes. The firſt is a bunch or prominence like a ſmal hillocke, at either end of which there is a boſome or cauity ending in another prominence before you come to their gibbous part. Into the corners of theſe boſomes the diuided veſſelles [table xxii. [l h]] doe offer themſelues thence to be diſperſed into the ſubſtance of the kidneyes, one branch into the vpper angle of one boſome, another into the lower angle of the other, out of which alſo the vreter proceedeth.

The veſſels. Veines. *Vena adipoſa.*

The veſſels which are ſent vnto the kidneies are of all ſorts, Veines, Arteries & Nerues. The Veines proceede out of the hollow veine; one of them [table 17. [x x]] is that fatty vein whereof we haue ſpoken, and it is double; one on the right hand, and another on the left: The right iſſueth very rarely out of the trunk of the hollow veine, but moſt what out of the emulgent; the left alwayes out of the hollow veine, and is diuerſly diſtributed to his vtter coate to water or bedew the ſame; ſometimes alſo it offers a little branch to the glandule which we ſpake of adioyned to the kidney, which when it hath perforated it is againe conſumed in this coate of the kidney.

The Emulgent veines.

The other veine, of his office is called the emulgent or ſucker [table 17. [a b], table 22. [h i]] moſt commonly one on each ſide; for in the framing of theſe veſſels Nature often diuerſly diſports her ſelfe, ſo that they differ oftentimes not onely in ſeuerall bodies, but euen in the ſame.

Why the Emulgent is ſo great. Whence the Emulgent ariſeth. The values of the Emulgent

This emulgent is a notable veſſell, and the greateſt of all that ariſe out of the hollow veine; not that the Kidneyes ſtand in neede of ſo great ſtore of nouriſhment, but that the ſerous bloud may haue a free & expedite paſſage. It ariſeth ſeldom directly out of the trunk of the hollow vein, but is carried with an oblique but ſhort progreſſe downward, and being parted into 2. branches, is inſerted into the ſaddle ſide of the Kidney, carrying thither the ſerous or watery bloud out of the hollow veine. In theſe emulgents wee haue obſerued certaine values or floud-gates which hinder the recourſe of the whay or vrine into the hollow veine. With theſe is vnited a branch one or two of the veine *ſine pari* or without his fellow, (of which we ſhall entreate more fitly in another place) that there might be a conſent betweene the Kidneyes and the breaſt.

The arteries of the kidnies Their vſe.

Arteries it hath of each ſide one [table 17. vnder [a b], table 22. vnder [h i], table 18. character [3, 5.]] from the trunk of the great Arterie; great emulgents or ſuckers alſo, which do purge wateriſh moyſture, plentifully contayned in the Arteries from the bloud, and withall doe allow heate to ouercome the cold of the Kidneyes, which *Galen* ſayth they acquired by the paſſage of the watery moyſture through them.

Theſe veſſels firſt parted into two, do then get into the cauities of the Reynes & are preſently diuided, commonly into foure braunches, and ſo are diſſeminated diuerſly into the whole ſubſtance of the Kidneyes [table xxi. figure 1. [a c]] till at length they are ſo by degrees ſeuered by manifold partitions, that they become as ſmall as hayres; then they approach vnto the Caruncles which are *ſpongy* peeces of fleſh, through which the whay is filtered or ſtreyned.

Why the kidneis haue no particular veins to nouriſh them. The nerues of the kidneyes.

The Kidneyes needed no other third veine differing from theſe whereby they ſhould bee nouriſhed, becauſe they doe not draw a pure excrement as the bladders doe, which therefore needed particular veines to carry their nouriſhment; but theſe veſſelles being full of bloud as well as of whay, doe nouriſh the kidneyes with the bloud, and ſend away the whay to be auoyded. They haue nerues on either ſide from the ſtomachicall branch of the ſixt paire (whence comes the great conſent betweene the ſtomacke and the kidneyes, and the ſubuerſion of the ſtomacke, and frequent vomits in Nephriticall paſsions or diſeaſes of the kidneyes) which deſcend downeward to the rootes of the ſpondelles or racke-bones of the loynes; and are diſtributed into the proper membrane of the kidneyes. Moreouer from about the originall of the Arteries of the meſenterie, there doe proceede a fewe tendrils of ſinewes mingled together; part of which goe vnto the kidneyes and the glandules that lye vpon them, the other part together with the emulgent Arteries doe inſinuate themſelues into the hollowneſſe of the kidney, and are diſtributed through their ſubſtance. Hence it is

that Nephriticall patients haue not onely a certaine dull ſence of paine, but alſo moſt vehement torments in their kidneyes; not onely therefore becauſe their holes or dennes, as *Galen* ſayth, are not wide but narrow, and the kidneyes becauſe of the firmenes of their ſubſtance cannot be ſtretched as the bladder may, but eſpecially becauſe of theſe nerues diſtributed through their ſubſtance; notwithſtanding the paine of the ſtone is greater when it entreth into the vreter, both becauſe of his exquiſite ſence, as alſo becauſe of the ſtraightnes of the paſſage through which the ſtone falling, muſt needes teare it almoſt with ſtretching, which paine wee ſee not alwayes to follow thoſe whoſe paſſages are dilated by the often comming downe of ſtones.

Eſpecially.

The inner venter or cauitie of the kidney, hath a hollowneſſe made of a ſinewey membrane which the emulgent veſſelles doe not produce, for they determine into exceeding hairy threds; but the vreters, which becomming firſt broade in the hollowneſſe [table 21. figure 1.F] of the kidneyes are the matter of it. At whoſe ſide on either part before the veſſels are diuided into leſſe braunches, the ſubſtance of the kidneyes appeareth looſe and vnequall (the Anatomiſts call it *Cauernoſa, ſpongi formis, eroſa*) when the fat that compaſſeth it about is diligently remoued.

The inner venter of the kidnies.

The vreters are diuided into great braunches, firſt double or treble (as in the next chapter ſhall appeare) and then into many others, not (after the manner of other veſſelles) ſtill leſſened into hairie threds, but broade in the end (ſo that a man may obſerue eight or ten branches like canels or pipes) that they may better receiue the Caruncles before ſpoken of. For thoſe Caruncles which are like ſmall glandules in the endes of all the veſſels (and of a paler colour becauſe they are of a harder fleſh then the reſt of the kidney) being produced out of the ſubſtance of the kidney, and ſomewhat ſharpe like vnto the nipples of breaſts, inſinuating themſelues into the ſaid veſſels in manner of a couer or ſtopple, doe ſtoppe them vp; which if they be cut according to their length, a man may obſerue in them certain furrowes and tunnelles as ſmall as hayres. Wherefore, being ſo finely bored that they will ſcarcely admit a haire; by them the whay or ſerous humour coloured with choler, is ſeparated from the bloud, and is inſenſiblie percolated or drayned into the pipes of the vreters or membranous tunnels (this is called the *Colatorie*) and gathered together in that common hollowneſſe, and thence is ſent downeward by the vreters into the bladder: it may bee theſe furrowie paſſages are hollowed in the ſubſtance of the kidney like as the holes in the nipples of the breaſts. And theſe ſpongie Caruncles had neede to be ſo finely bored, leaſt the bloud which together with the vrine and choler is drawne by the emulgents but for their proper nouriſhment, ſhould with them alſo paſſe away into the bladder (which we ſee ſometimes to happen and that without paine; when either the ſeparating or reteyning vertues of the kidneyes are decayed or thoſe ſmall paſſages widened) conſidering that this ſeparation is made not by concoction where Nature is her owne chooſer, but by transfuſion; although wee doe not deny but that theſe excrements do here receiue a kinde of elaboration though not a concoction.

The vreters.

The colatorie

The ſeparation of the whey is by transfuſion not by concoction.

This bloud thus remayning behind, is as it were ſucked by the fleſh of the kidneyes, and is ſprinkled vpon it like a kinde of dew; from whence by degrees after the manner of a vapour it is ſcattered into his whole body, cleaueth, is vnited to it, and finally becommeth the nouriſhment of the kidneyes. But becauſe being ſo thin it nouriſheth but ſlenderly, it is continually and in great quantity drawne in, together with much vrine, which (the bloud remayning behinde) inſenſibly droppeth through thoſe Caruncles.

How the kidnies are nouriſhed.

Theſe things, although they differ from the common opinion of ſome others, yet may they fitly be demonſtrated if you put a Probe into the veſſels as they enter in, and the vreter as it goeth out, and then make inciſion at the ſaddle ſide of the kidney; and yet much better & more elegantly are theſe paſſages ſhewed, if you ſeparate the fleſh of the kidney from his veſſelles; which ſeparation hath aboundantly ſatisfied vs in this point: and therefore we haue exhibited it in the xxi. Table and the firſt Figure.

The triall of the truth in this diſcourſe of the paſſage of the vrine.

But becauſe theſe things doe not ſo appeare in Dogges as we haue nowe ſaide, and yet young Students for want of Mens bodies are often faine to diſſect the kidneyes of Dogs: we thought it not amiſſe, here brieflie to inſert the deſcription of Dogs kidneyes alſo.

The ſtructure therefore of a Dogges kidney delineated in the ſecond Figure of this 21. Table is on this manner.

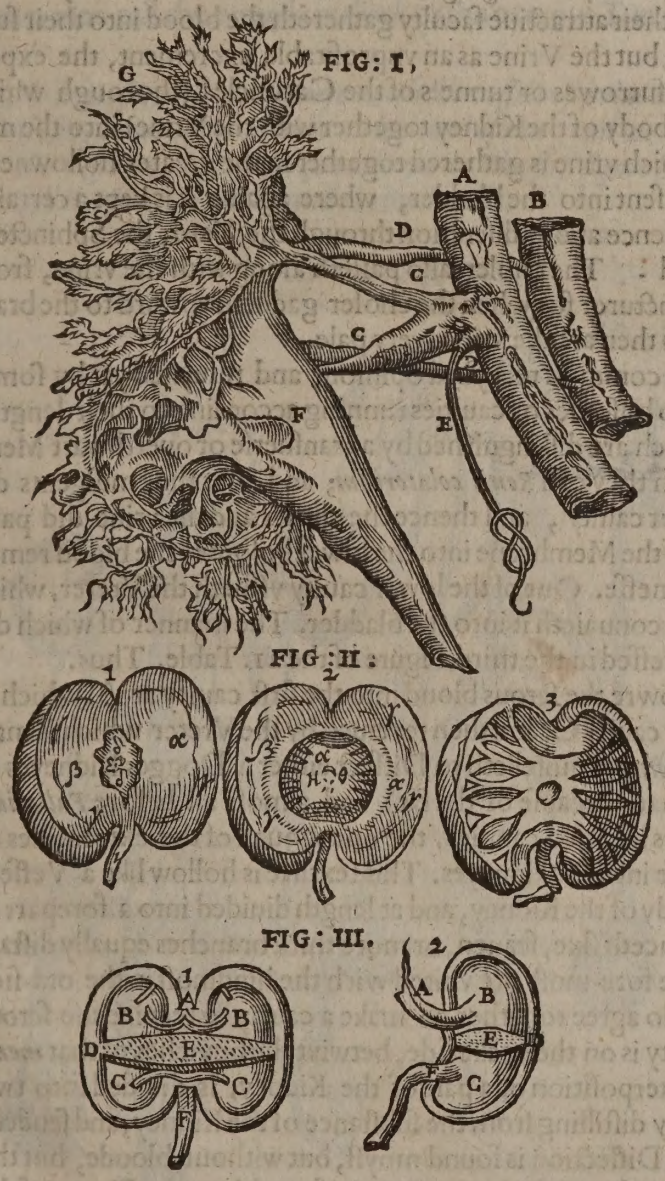
The membrane immediatelie couering the kidney entreth into his cauity where it is reflected or returned and on both ſides ſpred abroad, like as is the membranous bodie from which

The deſcription of a dogs kidnie.

Fig. 1. *sheweth the vessells of the Kidneyes separated from the flesh.* *Fig.* 2. *sheweth the Kidnies Dissected according vnto Vesalius. The first is the Kidney cut according to the length through the gibbous part, so as the slit reacheth vnto the second* sinus *or cauity of it, no part of the kidney taken away. The second exhibiteth the Kidney where all the substance or partition which is called* Septum renis *is sliced away in a compasse, that the second cauity may better appeare. The third sheweth al the branches of the first cauity or* sinus, *the flesh of the Kidney being quite taken away.*

Fig. 3. *expresseth the deuise of some men concerning the percolation or streyning, of the whey, the first sheweth the Kidney dissected from the gibbous part toward the Hollow part, together with the* Cribrum *or Siue: the second sheweth the middle part of the Kidney.*

TABVLA XXI.



A. The trunke of the Hollow veine.

B The trunk of the great artery

C C The emulgent veine diuided into two.

D D The double emulgent artery.

E The spermaticall veine arising from the trunke of the hollow veine.

F The latitude of the Vreter in the bodye of the kidney; in the broader part whereof oftentimes are engendred, ragged & branched stones.

Fig. 2. α β 1, 2. The forepart & hinder part of the kidney.

γ γ, 1, 2 The orificies of the branches of the first *sinus* or cauity of the kidneyes.

δ δ, 1. The body of the first *sinus* into which the veine & the artery of the kidney do determine.

ε ε 1, 2. The hole where the *Vreter* begins.

ι, 1, 2. A part of the *Vreter.*

α β 2. The circle betweene α and β, shewes the second *Sinus* of the kidney.

η θ 2. The backe part of this *sinus* is marked with η, the forepart with θ.

Fig. 3. The emulgent veine and artery.

B B. The *sinus* or cauitie into which the vrine is streyned out of the first cauity.

C C. The cauity into which some think the vesselles do powre the *serous* or whaey bloud.

D D. The substance of the kidney compassing this cauity round about.

E E. The *Draine* of the Kidney called *Celatorium*, or the Membrane perforated like a siue, through which the vrine passeth say some, together with the Choler that coloreth it out of the cauity marked with B, into the cauity marked with C.

F F. The Vreter which receyueth the vrine out of the second Cauity, and leadeth it into the bladder.

which the Vreters do proceede. To this Membrane cleaueth the fat whereupon the distribution of the emulgents into the Kidnies doth leane, as vppon a pillow or boulster for their security. It hath also many holes through which the vessels enter into the Kidneyes. Next followeth that which is called *The Membranous body*, which is diuided into manie branches, and as a couer compasseth the vessels, it maketh a cauity which conteyneth the vessels and the fat.

Vpon this *Membranous body* lyeth the cauity of the Kidney, in the middeſt whereof hangeth a part of the ſubſtance of the Kidney regarding the gibbous ſide, differing in colour from the reſt, and wanting the Membranous couer before naméd. It is like a new Moone, and hangeth like a partition, ſo leaning vpon the *Membranous body*, that the cauities of the ſame Kidney ſeemeth to be double. But in the Kidney of a man there are no ſuch cauitie to be found, but the emulgent veſſels and the Vreters are diuided through his ſubſtance into many branches, and the cauities which are in the Kidneyes are wrought as it were out of them.

The vſe of the Kidneyes.

The vſe of the Kidneyes is to draw from the whole maſſe of bloode, as well that of the Veines, as that of the Arteries, the ſerous humour through the emulgent veſſels by a proper attractiue faculty ariſing from the ſimilitude of ſubſtance betweene it and the kidnies, and ſo to purge both kinds of the blood, arteriall and venall from that excrement. For thoſe parts which through large orificies do draw their conuenient and familiar iuice, cannot draw it pure, ſimple, & ſincere, but with the admixtion of ſome other of a diuers kind. Wherefore together with the Vrine is drawne both much moyſt and thin bloud out of the Liuer, and much yellow choler, which the bladder of Gall did not attract before. But the Vrine or whey by the force of the kidneyes is ſegregated from the blood in the very concoction of their Aliment, & beſide their attractiue faculty gathereth the blood into their ſubſtance for the nouriſhment of it; but the Vrine as an vnprofitable excrement, the expelling vertue ſtraineth through the furrowes or tunnels of the Caruncles (thorough which alſo the grauell paſſeth from the body of the Kidney together with the Vrine) into the mẽbranous pipes of the Vreters: which vrine is gathered together in the greater hollowneſſe of the Vreters, and from them is ſent into the bladder, where againe it is kept a certaine time, and at length is expelled thence at our diſcretion through the Yard, the Sphincter-Muſcle being relaxed or looſened. The choler alſo paſſeth along with the vrine, from whence they haue their yellow tincture: for when the choler gaddeth vpward to the brain (as in phrenſies it is not very rare) then are the vrines very pale.

How the vrines are colored yellow.

Before *Veſalius* time it was a common receyued opinion, and reteyned yet by ſome, that in the Kidneyes there are two boſomes or cauities running according to their length; one higher, another lower, which are diſtinguiſhed by a tranſuerſe or ouerthwart Membrane perforated like a Siue which they call *Renis colatorium*; and that the emulgents did powre ſerous blood into the vpper cauity, and thence the choler and the vrine did paſſe through the fine ſearcing holes of the Membrane into the lower boſome; the blood remaining behinde becauſe of his thickneſſe. Out of the lower cauity yſſueth the Vreter, which receyueth the ſtreyned vrine, and conuaieth it into the bladder. The manner of which deduction of the vrine we haue expreſſed in the third Figure of the 21. Table. Thus.

The common opiniõ of the way of the vrine before *Veſalius* time.

The emulgent veſſels which powre the ſerous bloud into the firſt cauity at A. which is ſtrained through E into the lower cauity C. and then receiued by the Vreter which is marked with F. Afterward *Veſalius* (who counſelleth to Diſſect either a Dogges Kidneyes or a Goats, fearing to deale with a mans becauſe of the fat) and almoſt all before *Fallopius*, were of opinion, that the Kidneyes had two cauities, the one wouen of the extremities or ends of the emulgents which paſſe into the kidneyes. This texture is hollow like a Veſſell, and is diſtributed through the body of the Kidney, and at length diuided into a forepart & a backe part, each of which produceth ſixe, ſeauen, or more thick branches equally diſtant one from another, yet ſo that the fore-moſt are vnited with the hindmoſt in the out-ſide where they make a circle, and ſo do agree together to make a cauity to receiue the ſerous blood. The other boſome or cauity is on the backe ſide, betwixt the branches of that *membranous* body. And this by the interpoſition of a part of the Kidney, is diuided into two parts, where it receyueth the whey diſtilling from the ſubſtance of the Kidney, and ſendeth it into the Vreters. This cauity in Diſſection is found moyſt, but without bloode, but the former is alwayes found full of blood, and this conceite is anſwerable to the Figure of the Dogs kidneyes. [Tab.21,fig.2] And thus much of the Kidneyes.

Veſalius opinion.

CHAP.

CHAP. XV. *Of the Vreters or paſſages of vrine.*

THE Vreters or vrine leaders or veſſels of Vrine, the Greekes call ἐρετῆρας, as a man ſhould ſay the piſſers. *Hippocrates de Glandulis* calleth them ὀχετοὺς or conduit pipes. They are two veſſels [Tab.xvii, c d. Tab: ii, lib.4. qq. Tab.xxii m n] on eyther ſide one (ſometimes, but ſeldome two or more, yet meeting in one before their inſertion) which lying vpon the Muſcles of the Loynes, and a little reflected or turned inward leaſt they ſhould make an oblique paſſage, doe deſcend betwixt the two Membranes of the *Peritonæum* or rimme of the belly vnto which they are knit, and ſo are ioyned to the bladder. [Table xxii, ♁. Table xvi, char. 18, 20.] The Vreters.

Their courſe.

Their figure is round, a palme long & of the bredth of a *ſtraw*; in thoſe that are much troubled with the ſtone dilated to the proportion of a ſmal gut; hollow & running aſide or obliquely like the letter *ſ*. In women broader then in men, but right and ſhort, and hence it is that they auoide ſtones with much leſſe pain then men. Their ſubſtance is properly white (whence ſome call them the *white veines*) without blood thicke and neruous, (whereupon other men call the *neruoſi canaliculi* or the neruous Tunnels) which makes them ſo ſtrong. Figure.

Subſtance.

Table xxii. ſheweth the Kidneyes with the veſſels of vrine and of ſeede; a part of the Hollow veine and of the great Arterie, the Teſticles, the bladder, and the yard. The firſt figure ſheweth the fore-ſide, the ſecond the hinder ſide.

TABVLA XXII.

FIG. I.

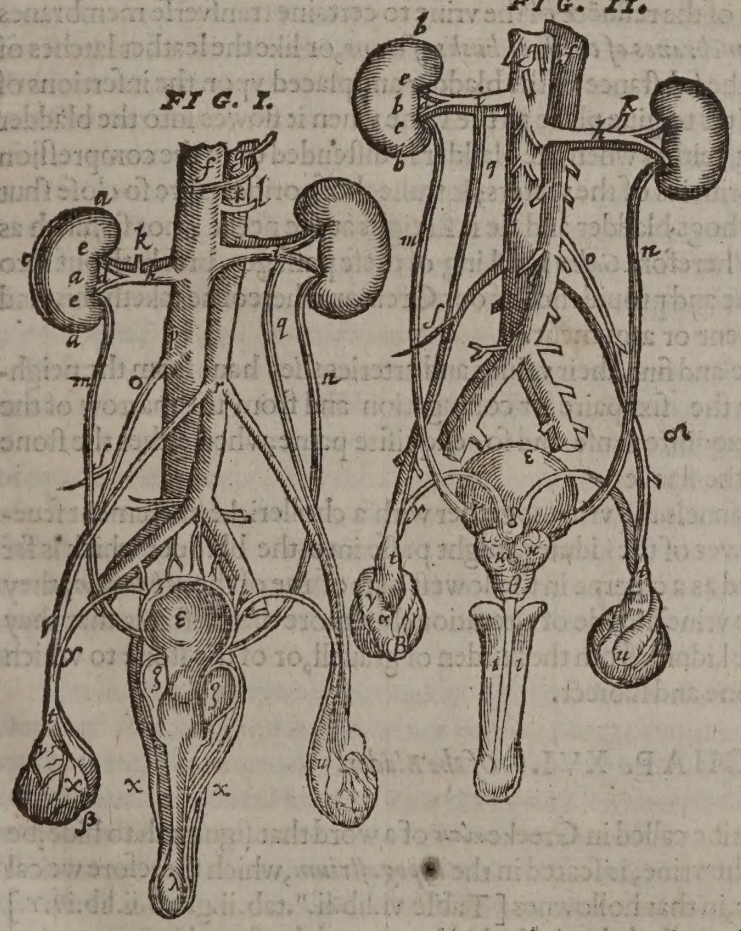


FIG. II.

aaa 1. The forpart of the right kidney.
bbb 2. the back part of the left kidney.
c 1. The outward ſide.
dd 1,2. the inner ſide.
ee 1,2. the two cauities where into the emulgent veſſelles are inſerted.
ff 1,2. the trunke of the Hollow veine.
gg 1 2. The trunk of the great artery.
hi, 1,2. the emulgent veine & artery.
kk 1,2. the right fatty veine.
l 1, the left fatty vein.
* *i*. the Cœliacall artery.
m n, 1,2. the vreters.
o p q, 1,2, the right ſpermatick veine which ariſeth neere *p*, the left neere *q*.
r r, the place where the arteries of the ſeede do ariſe.
ſ 1,2. Smal branches diſtributed from the ſpermaticall veines to the *Peritonæum*.
t 1,2, the ſpiry bodden bodie, cald *Varicoſum vas pyramidale*.
v 1,2, the *Paraſtatæ* or *Epididymis*.
x 1, the teſticle couered yet in his coate.
y 1,2, the place where the leading veſſell called *Vas deferens* doth ariſe.
α 1,2. the deſcent of the ſame leading veſſell.

β 1,2, The revolution of the ſame leading veſſell. *γ* 1 2, the paſſage of the ſame veſſel reflected like a re-current nerue. *δ* 2. the meeting of the ſame leading veſſels. *ε* 1,2, the bladder of Vrine, the firſt figure ſheweth it open, the ſecond ſheweth the back parts. *ζζ* 1, the ſmal bladders of ſeede opened. *ηη*, 2, the Glandules called *glandulæ proſtatæ*. *θ* 2, the ſphincter Muſcle of the bladder. *ι*, 2, *ι*, the two bodies which make the ſubſtance of the yard. *κκ*, 1, the veſſels which go vnto the yard, and the necke of the bladder. *λ* 1, the paſſage which is common to the vrine and the ſeede, cut open. ♁, the implantation of the vreters into the bladder.

This kinde of ſubſtance is found in no other part of the bodie vnleſſe it be in the bladder, to whoſe inward ſubſtance they are verie like, and to which they are continuated; by reaſon of which ſubſtance and beſide, becauſe they may not be ſeuered from the bladder without breaking, whereas they may from the kidneys whole and ſound, it may be lawfull to ſay, that they haue their original from the bladder, althogh our great Ancients, *Hippocrtaes*, *Ariſtotle* and *Galen* haue taught otherwiſe, namely, that they ariſe from the Cauitie of the kidnies. This ſubſtance, gifted with oblique fibres for diſtinction ſake, if any man will ſay is the proper and peculiar coate of the veſſell, which a common membrane doth inueſt giuen him for further ſtrength from the *peritonæum*, we will not gaine ſay him.

Hip. de nat ſœt. Ariſt. 3. Hiſt. Animal 4. Gal. 6. Epid. Com. 5. text 4.

The proper coate of the veſſels.

But theſe vreters after they haue incompaſſed [Tab. 21. fig. 1.] the inward *venter* or cauitie of the kidnie and made 8. or 10. pipes, they paſſe out at the ſaddle ſide, or if you will rather ſay thus, when the vreter is gone into the kidnie (of a man not of a dog,) becomming ſomewhat broader, it is diuided into three branches like the emulgents, and is diſtributed into the vpper, the lower, and the middle region of the kidnie, of which the vpper and lower are againe ſubdiuided each of them into 3. and the middle into two; theſe being ſhort & large haue broad ends, wherein euerie one of them receiue the glandule which we ſaid was like the nipple of a womans breaſt, ariſing out of the fleſh of the kidnies in the manner of a fleſhie ſtopple, that ſo through them the vrine might be ſtreined into euery one of the pipes or tunnels.

Their diuarication in the kidneyes.

Often many of theſe branches are perforated in the middle likewiſe, wheras in their vtter mouths they receiue a glandule alſo. They are implanted into the backward and loweſt part [Tab. 22. Ψ.] of the bladder, (for their implantation could not be more commodious becauſe the bladder cleaueth to the right gut) not farre from the neck betwixt his two proper membranes hauing the diſtance of two fingers betweene them, and ſo with an oblique inſertion they pierce the cauitie of the bladder; but their paſſage or entrãce is very narrow; by which kind of inſertion the returne of the vrine toward the kidnies againe is foreletted. Some aſcribe this hinderance of the refluẽce of the vrine to certaine tranſverſe membranes like vnto values, or the *ſmall mẽbranes of chaffe or husks of corne*, or like the leather latches of bellowes, litle differing from the ſubſtance of the bladder and placed vpon the inſertions of the vreters, whoſe office alſo it is to giue place to the vrine when it flowes into the bladder & to hinder it from returning, either when the bladder is diſtended or in the compreſſion of the belly, by ſtopping the orificies of the vreters; & trulie thoſe orificies are ſo cloſe ſhut vp, that when children blow a hogs bladder and tie it ſtreight at the necke, not ſo much as the aire can be preſſed out. Wherefore *Galen* ſpeaking of theſe paſſages, breaketh out into an admiration of the wiſedome and prouidence of our Creator, whereof he taketh this, and iuſtly to, to be a great document or argument.

Their implantation into the bladder.

The reaſon of this implantation.

In 6. Epid. com. 5. text 4.

Their veſſels.

Their veſſels are very hairie and fine, their veines and arteries they haue from the neighbor parts. Their nerues from the ſixt paire or coniugation and from the marrow of the loynes, whence comes their exquiſite ſenſe and ſo exquiſite paine, when either the ſtone is in them or paſſeth away by the flankes.

The vſe of the vreters.

Their vſe is, that in their channels the vrine together with a chollericke excrement ſeuered from the blood by the power of the kidnies, might paſſe into the bladder which is far diſtant from them, and placed as a ciſterne in the loweſt part of the of the *Abdomen*, they are alſo thought to giue to the vrine a kinde of alteration; but more manifeſt it is that they do good ſeruice in freeing the kidnies from the burden of grauell, or of the ſtone to which all ages and ſexes are very prone and ſubiect.

CHAP. XVI. *Of the Blader.*

The bladder.

THe bladder of vrine called in Greeke κύστις of a word that ſignifieth to hide, becauſe it hideth the vrine, is ſeated in the *hypogaſtrium*, which therefore we cal the watercourſe, in that hollownes [Table vi. lib. ii. ". tab. ii. g. tab. ii. lib. iv. ϒ.] which is made by the holy bone, the hip bones and the ſhare bones meeting together, all which cauitie is taken vp by the bladder (for it is a large ciſtern or veſſell) and the right gut, cloſe to which the necke of the bladder lieth connected or faſtened. In women the bladder lieth betweene the wombe [Tab. vi. lib. 4. T. ſheweth the bladder, L the wombe, but Tab. xxvii. of this booke *ſ* ſhewes the bladder and p the womb,] and the ſhare bone, as well becauſe the draining veſſels for the excrements of aliment are

The ſituatiõ.

moſt

moſt conueniently placed in the lower parts for their eaſier euacuation, as alſo becauſe of the entrails ſeruing for nouriſhmēt, that thoſe which are the moſt noble might haue the vp-place. Theſe bones alſo are ordained for defence of a part ſo verie neceſſarie, and of ſo exquiſite ſenſe, albeit the cauity which they make, was made for other vſes, of which wee will heare more heereafter. His ſeate is betweene the two coates of the *Peritonæum* which make as it were a particular *venter* (whence haply it was that *Diocles* diuided the bodie into the head, the cheſt, the belly, and the bladder) vnder the Share-bone when it is empty; and in Diſſection it can ſcarſely bee found at the firſt view, for it exceedeth not the greatnes of a reaſonable peare, but when it is full it is ſtretched out into the hollowneſſe of the very belly, and may be felt aboue the groine.

Between the two coates of the *Peritonæum*. *Diocles.*

The bottome and the fore-part are tyed to the *Peritonæum*, [Tab. vi, lib 2, I. Table 2, *] but looſely by two ties. The firſt is a Ligament [Table vi, lib 2, b. Table 2, 1. Table xxiii, fig. 7. 8. yy.] originally ariſing from [tab. xxiii. fig. 7. 8. ſ] his bottome and carried to the nauill, [ta. xxiii. fig. 7. 8. r.] which they cal *Vrachus* in the infant. And this ligament is faſtened to the middle of the bladder. The other tie is of two vmbilical [tab. vi. lib. 2. a d, tab. 2. k l. tab. xxiii. fig. 7. 8. x.] arteries dryed, that when a man goes vpright, it might fall vpon his owne necke and ſo hinder his execretion. In dogges the bottome of it groweth not to the *Peritonæum*, but hangeth by a certaine proceſſe, moreouer in them it is very white, ſmoth at the bottome and ſlipperie, as it is alſo on the inſide [tab. xxii. fig. 1. e.] and lined ouer with a wateriſh humour.

The conneꝛion.

His figure is long, a little round, [tab. xxii. fig. 3. 7. 8. fig. 2. e tab. 23. ſ] which ſome haue likned to a ſphere, ſome to a gourd; for if it were round as a bowle is roūd, it wold be too much preſſed by the parts that lie about it. It is hollow that it might receiue a great quantitie of liquor & frō a large bottom by degrees growing narrower it endeth in a ſtreight neck, wherfore the parts of the bladder are two, the body and the necke. The ſubſtance of it is partly membranous or neruous, both for the commodious extēſion becauſe it is often to be filled & to conteine the vrine, that we might not alwayes be conſtrained, but within conuenient time to yeeld it forth; and for his corrugation or knitting vp together after euacuation: Partly alſo the ſubſtance is fleſhie. It hath three membrances, one common and two proper. The common is the vtter and is from the *Peritonæum*, a ſtrong and thicke one, wherewith it is couered ouer and ſtrengthened, that though it be diſtended with aboundance of water it ſhould not be broken or rent; by this alſo it is tyed in men to the right gut, and in women to the necke [Tab. xxvii. t is the necke of the bladder inſerted into the necke of the wombe aboue the priuities at u; Tab. viii. lib. 4. fig. 1. o. the neck of the bladder, and fig. 3. e the necke of the bladder, and d the neck of the wombe] of the matrix or wombe, and to the bones of the hippes which are next vnto it.

The figure.

The part of the bladder.

The ſubſtance

The membranes 3. One common.

Two proper.

The two proper membranes ioyned together are nowe thicker now thinner, as they are diſtended or anguſtated or ſtreightned; which in the vppermoſt part of the bottome and about the necke becauſe of the inſertion of the vreters are harder and thicker. The inner of theſe is tranſparent, very white, thinne, neruous, wouen exceeding thicke with all kind of neruous fibres, as alſo are all other membranes which ſtand in neede to be much diſtended and contracted. The right fibres are inmoſt, the tranſuerſe outmoſt, the oblique in the middle according to the order of the functions as they ſay of attraction, retention and expulſion; which wee ſay are ordayned for the better conteyning and expelling of the vrine.

The fibres of the inner membrane.

This inner membrane if the bladder be a little blowne, may be ſeparated from the vtter. But that this fine membrane be not hurt by the acrimonie of the vrine becauſe it is of exquiſite ſenſe, the inner cauitie of his bottome is rugous and ful of folds and plights, and mucous or ſlimie, (ſome ſay this ſlime is a kind of *Fibrous* ſubſtance) or rather it is defended with a cruſty coate engendered of the excrements of the third concoction of the bladder. The vtter of the proper membranes is thicker, ſprinkled with fleſhy fibres, yet not red as are the fibres in the muſcles, but whitiſn ſuch as appeare in the coates of the ſtomacke, and the guts: ſuch they ſeeme becauſe they are placed betweene white membranes: although ſometimes by affluxion or affluence of blood they become ſo conſpicuous, that a man would ſay it were a fleſhy membrane.

The vſe of the fibres.

It hath theſe fibres as well for the preſeruation not onely of the heate which otherwiſe would bee very weake; but alſo of the vrine from falling by the fibres of the inner membranes much diſtended in repletion: ſo, that theſe fibres being contracted or drawn toward

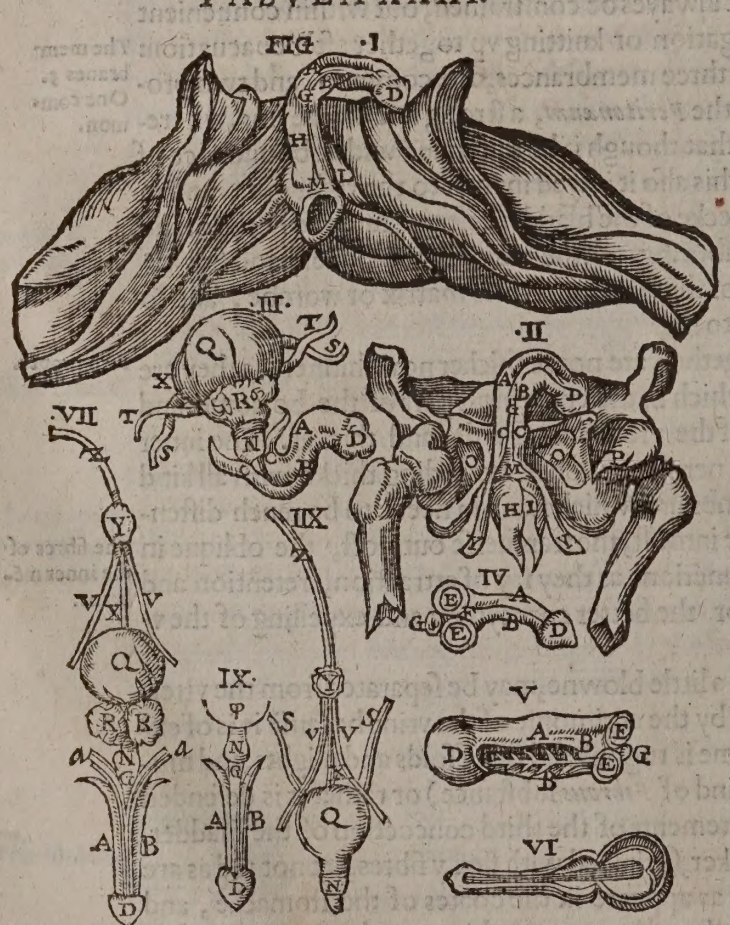
their

their originall by like little Muſcles; by ſtrengthening the bladder, which by the helpe of theſe knits it ſelfe together, it might exclude or ſhut out euen the leaſt thinges conteyned therein.

The paſſage. It hath three holes or perforated paſſages, two in the backward and lower part a little before it end in the necke, where the inſertion of the Vreters [Tab:xxii,fig: 1,4, Tab. viii, figure 1,H] betwixt the two proper coates, by which the Vrine driuen downe from the kidneyes, is of it owne accord powred into it, not by reſudation or ſweating through, but by open paſſages. [Tab:viii,lib.4.fig.1 M] To which (that the Vrine might not recoile or flow backe, no nor the very winde when the bladder is diſtended) beſide the oblique inſertion

Tab.xxiii.demonſtrateth the Muſcles of the yard,of the Fundament and of the Bladder, and the three bodies of the yard.
The firſt and ſecond Figures ſhew the yard excoriated, cleauing yet to the bottome of the ſhare bone.
The third ſheweth the ſame ſeparated with his Veſſels.
The fourth and fifth, the yarde cut away, and Diſſected ouerthwart.
The ſixt, the Canell or pipe of the yard, diuided at the entrance into the bladder.
The ſeauenth, the fore-part of the bladder and the yarde, together with the vmbilicall veſſels.
The eight figure ſheweth the bladder of a woman with the vmbilicall veſſels, and a part of the vreters.
The ninth ſheweth the backe parts of the bodies of the yard.

TABVLA XXIII.



A B, 1,2,3,4,5,7,9. The two bodyes that make the yard.
C C, 2,3. The place where theſe two bodies do ariſe.
D, 1,2,3,4,5,7,9. The nut of the Yarde, called *glans Penis*.
E E, 4:5. The foungous and red ſubſtance of the bodies of the yard.
F, 4.5. The mutual connexion of the bodies of the yarde, and the neruous outward ſubſtance of the ſame, compaſsing round about the former fungous ſubſtance.
G, 1,2,4,5,7,9. The paſſage of the vrine, or the common pipe running vnder the yard all along his length.
H I, 1, 2. The firſt paire of Muſcles of the yarde which in the firſt figure doe yet grow to it, but in the ſecond they hāg from their originall.
K, L, 1,2. The ſecond paire of the Muſcles of the yard; in the firſt figure growing to, in the ſecond hanging from their inſertion.
M 1,2. The ſphincter of the right gut.
N, 3,7.8,9. The round ſphincter muſcle of the bladder.
O O. A Membrane which is ouer the holes of the ſhare bone.
P 2. A round Ligament from the *Coxa* vnto the head of the thigh.
Q, 3,7,8. The body of the bladder.
R, 3,7. The *Proſtata* into which the ſeede when it is perfectly laboured is led.
§ S, 3,8. Portions of the vreters.
T T 3. Portions of the veſſels which lead downe the ſeede.
V V, 7,8. The vmbilicall Arteries.
X 7,8. The Ligament of the bladder called *Vrachus*.
Y 7,8. The nauell or *vmbilicus*.
Z, 7,8. The vmbilicall veine.
a a 7. The veine and artery of the yard.
b 5. The Artery diſtributed through the body of the yard.

of the Vreters, there is ſet on either ſide a ſinal Membrane or value, after the maner of the leather latches of Bellowes; but this is an improper acceptation of a Value.

The outlet of the bladder. The third paſſage or the outlet of the bladder, yeeldeth way vnto the vrine, and is in the necke which is long enough, but ſtraight, conueyed vnder the Share-bones, and placed vnder the ſubſtances or bodies of the Yard, and therefore a little crooked, and is carried

ed vpward from the Fundament vnto the beginning of the virile Member, to make his pipe or hollow Canell, and common paſſage.

In women this outlet is ſhorter [Table xxiii, fig:8. about ᴺ] and broader [Table xxvii, ᵗ] carried right downeward, and is inſerted into the necke of the Matrixe at the vtter and vpper end. Through this paſſage women auoide their vrine; men both their vrine and their ſeede, therefore men haue behind it [Tab. xxii, fig: 2, ⁿⁿ, Tab: xxiii, fig: 3, 7, ᴿ] two Glandules placed, called by *Galen proſtatæ*, thicke and white, receyuing the inſertion of the Veſſels, which leade the ſeede called *vaſa deferentia*. *Gal. 16. vſu part. cap. 9.*

The necke of the bladder. The necke of the bladder is moſt what fleſhy wouen with many Fibres, ſome right vnder which lye hid tranſuerſe alſo, which are placed at the beginning of this neck aboue the ſaide Glandules, and do contract it ſo, that the Vrine cannot drop out againſt our willes in any compreſsion of the *Abdomen*, and ſtrong retention of the breath; wherefore from the vſe it is called the Sphincter Muſcle, and from the Figure of the Greeke Letter *ſigma*, *ſigmoides*. The ſimilitude of the bladder. Theſe Fibres being looſened not without a voluntary and ſtrong compreſsion of the Muſcles of the *Abdomen* and the *Diaphragma*, the vrine eyther by his quantity or quality and acrimony prouoking the bladder, is with contention or ſtrife piſſed forth: for if the vrine runne againſt our will, and without feeling, it is becauſe the Muſcle is either paralyticall, or too much cooled. But if this compreſsion of the vpper parts againe do ceaſe, the Fibres are contracted, and ſo the drops or remainders that continue yet in the paſſage are expelled.

If any man would ſee this tranſuerſe Muſcle lying betweene the right Fibres of the vtter coate and adioyned to the body of the glandules, hee muſt boyle the bladder lightly, or as we ſay parboyle it.

Furthermore below the glandules there are to be ſeen certaine tranſuerſe fibres encompaſsing [table xxii. figure 2 θ, table xxiii. figure 3. 7. 8. 9. ᴺ] the canale or paſſage which Anatomiſts haue hitherto ſhewed for the ſphincter. But if theſe were ſo, then ſeede coulde neuer paſſe without the vrine, as it hapneth in the *Gonorrhæa* or running of the Reines; for in the accompanying of a man with a woman, *the muſcle in this part muſt needes bee dilated*, which being ſo, the vrine together with the ſeede muſt needes fall away, as it commeth to paſſe in them that want the vpper ſphincter.

The veſſels of the bladder. His veſſels are veines, arteries, and ſinewes; the veines and arteries are on both hands at the ſides of the necke, that they might not be carried farre without a conuoy, and might bee alſo ſafely inſerted; and are doubly diuided; one part of them is diſtributed into the whole bladder with many ſmall threds. The other part which is the greater in man becauſe of the yarde, and the leſſer in women is carried downeward according to the deſcent of the necke. Veines. The veines ſerue for his nutrition, for it is not nouriſhed with vrine, neither doth it as the Kidneyes receiue any portion of bloud with the vrine, but onely the pure excrement, and therefore ſtands in need of proper veines for his nouriſhment. Arteries. The Arteries ſerue for the recreation and refreſhment of the life and heate: both of them proceede from the doubly diuided *Hypogaſtricall* braunch [table 8. ᵘᵘ] of the hollow veine and great Arterie: wherefore in the inflamation of the bladder the inner ankle veine is to be opened, but in women they ariſe from the veſſels which come vnto the necke of the Matrix. A good obſeruation.

Nerues. It hath notable Nerues from the branches of the ſixt coniugation which reach to the rootes of the ribs and from the marrow of the holy-bone, that the ſence of excretion might bee ſtirred vp at thoſe thinges which moleſt it; whence alſo come thoſe exceeding ſharpe paines that a man ſuffers when it is vlcerated, or but raw

The vſe of the bladder. His vſe is to receiue like a bottle not only the vrine, which is the excrement of the moiſt Aliment, by degrees ſtrayned through the Kidneyes and brought downe by the vreters; but alſo all dry excrements of which the ſtone is ingendered; which excrements the bladder doth not draw downe, but they are partly put downe by the kidneyes, partly they fall with their owne waight and of their owne accord, whence ſome call it the vrinall of the body. It alſo by conſtriction of the paſſage keepeth the water till a fit time of excretion, which it doth with a faculty mixed, that is partly Naturall and partly Animall, but the retention belongeth more properly to the Animall faculty, and the expulſion or excretion to the Naturall.

CHAP.

Of the Fundament. CHAP. XVII.

3. muſcles of the Fundament.

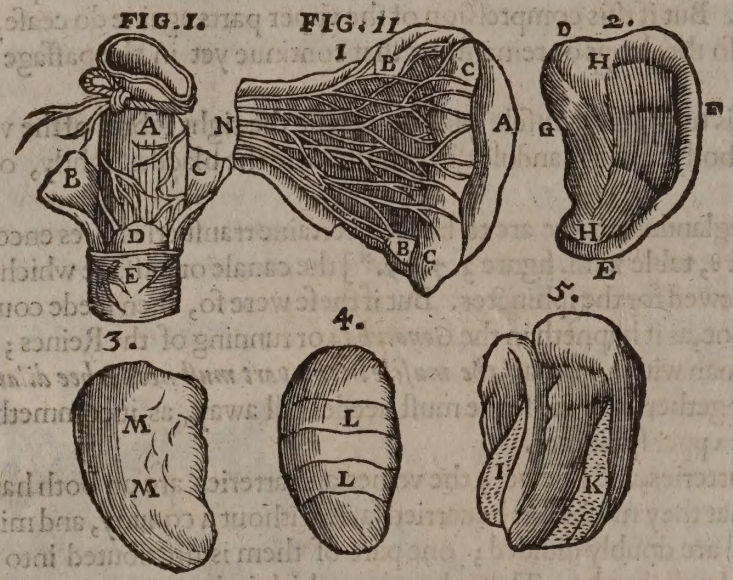
NExt to the Bladder lyeth the Fundament called in Latin *Podex* and *anus*, in Greeke πρωκτὸς ϗ ἄρχον. It is the end of the right gut [table 6. Figure ii, iii, [a]] and hath belonging to it three muſcles.

1. Sphincter.

The firſt is called the Sphincter [table 24. Figure 1.[E]] a round muſcle (whence it is called alſo the *Ringe*) cõpaſſing about the end of the right gut to hinder the exiture of the excrements. for it ſhutteth the paſſage ſo cloſe that not ſo much as any winde can get out. This affordeth a beginning [table 23. figure 1. 2.[M]] to the muſcles [table 23. Figure 1, [H I]] of the yarde. The other two muſcles are cal-

The firſt Figure ſheweth a part of the right gut, with his Muſcles cut from the body, which par[t] wee take away the guts, wee vſe to leaue.

TABVLA XXIII.



A. A part of the right gut, about which a ſtring is tyed.

BC. Two Muſcles drawing vp the fundament after excretion.

D. A Muſculous ſubſtance which groweth to the roote of the yarde, but in women it ioineth to the very lower part of their lap.

E The Sphincter or round Muſcle of the Fundament.

2. 3. *Leuatores.*

led *Leuatores ani* [table 6. Figure 2.3.[b c] table 24. figure 1.[B C]] the lifters of the fundament. They are inſerted into the vtter coate of the gut, and into the vpper part of the ſphincter, [table 24. figure 1.[E]] and grow alſo to the roote of the yarde and the necke of the wombe. [table 24. Figure 1.[D].] Their vſe is after excretion to retract the Fundament, and if they be weakned, men are conſtrayned to vſe their fingers to doe that office; but becauſe we ſhall ſpeake more of theſe muſcles in another place, this at this time ſhall bee ſufficient.

The Muſcles and Nerues ſcituated in the cauitie of the lower Belly. CHAP. XVIII.

BEſide the Muſcles of the *Abdomen* mentioned and but mentioned in the ninth Chapter of the ſecond Booke, and the muſcles of the Fundament named in the former Chapter, there are alſo other muſcles appearing in the lower belly when the parts aboue named are remoued. And thoſe are two paires lying vpon the ſpondels or rack-bones. The firſt is the ſixt muſcle moouing the thigh or the firſt of his *benders*, they are called in Greeke ψόαι, in Latine *Lumbales*. The ſecond is the ſeauenth mouing the thigh or the ſecond of his *benders*, and it is called *Iliacus internus* the inward flanke Muſcle, of which wee ſhall heare more in the hiſtory of the muſcles of the thigh.

Lumbales.
Iliacus internus

At the ſides of the loynes on either hand is a portion of the broade muſcle called *Latiſſimus*, which draweth the arme backeward and downeward, vnder which lyeth the ſquare muſcle called *Quadratus*, which is the firſt muſcle of the back. But in the very denne or cauity it ſelfe is the muſcle of the thigh, according to *Veſalius*, called *obturator internus*, and it

Latiſſimus.
Quadratus.
Obturator internus.

is

is the ſecond muſcle of thoſe that turne the thigh about.

There are alſo two ſorts of nerues diſperſed through the lower belly. Some proceeding from the ſixt paire of the marrow of the braine, from which are diſtributed branches to all the entralles herein contayned, of which wee haue ſpoken particularly in the particular hiſtorie, yet their production and continuation ſhall bee better inſiſted vppon afterward. Other ſinewes there are ariſing from the marrow of the backe, as it is contayned in the racke-bones of the Loynes and the holy-bone; wherfore theſe nerues are of 2. ſorts, ſome of the loyns others of the holy-bone: Of the loynes ſometimes foure ſometimes fiue paire, of the holy-bone alwayes fiue payre, of which we ſhall entreate in their proper place.

The nerues of the lower belly.

2. kinds of the loynes of the Holy-bone.

Of the loynes 4. or 5. paire.

Of the Holy-bone 5. paire.

The Bones of the lower Belly. CHAP. XIX.

THE Bones which together with the fleſhy partes doe make the lower Belly, although they compaſſe not the belly round about as the other two Regions are compaſſed, yet are there ſome of them on his back part, ſome on his ſides, and ſome before. On the pack part are the Loynes, the Holy-bone, and the Rumpe.

Of the Loynes there are fiue rack-bones [table 25. Figure 1, 2, from [b] to [c]] which are knit together with Cartilages and thicke ligaments, and aboue are tyed with the ſpondels [table 25. Figure 2.[a]] of the Cheſt, below they reſt vpon the Holy-bone. [table 25. figure 1, 2.[c].] The firſt of theſe Loyne racks is called νεφρίτης from the Kidneyes which leane vppon it, the laſt ſome haue called ὀσφαλίτης, that is the Vnder-propper.

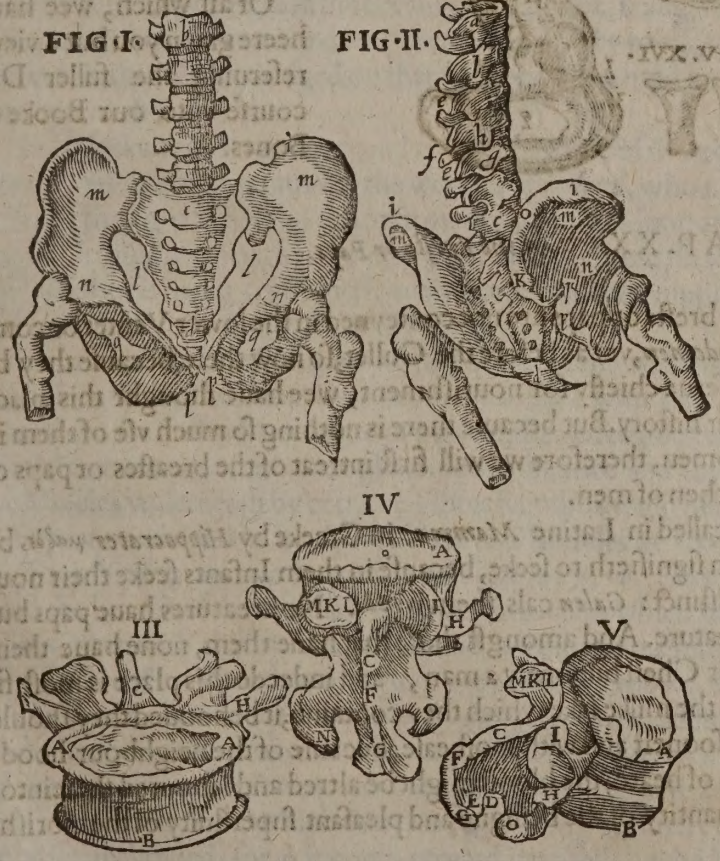
The bones on the back part. *Lumborum vertebræ.* νεφρίτης ὀσφαλίτης, Their *proceſſes*

They haue aſcendent proceſſes [table 25. figure, 4, 5,] deſcendent [table 25. Figure 4.[N]] and tranſuerſe, [table 25. Figure 2,[e e] Figure 3, 4, 5,[H]] the ſharp end of which they call the ſpine [table 25. Fig. 3, 4, 5.[c D].]

The Spine.

The firſt figure ſheweth the fore-part of the Bones of the lower Belly. The ſecond figure, the back-part. The third, fourth, and fift ſhew one of the fiue racke-bones of the Loynes, the third the fore-part, the fourth the backe-part, and the fift the ſide.

TABVLA. XXV.



The Holy-bone called ἱερὸν & πλατὺ, that is, the broad bone, is made of ſixe ſpondels [tab, xxv, Figure ii. from [c] to [d], table xxvi. Figure 6. from [A] to [F].]

Os ſacrum.

The Rumpe bone called κόκκυξ, or *os Coccygis* [tab. xxv. Figure 1, 2, [d], table 26, Fig. 8, 9.] it conſiſteth of three or foure bones [table 26. Fig, 6, 7, from [G] to [K]] and two griſtles; one, where it is ioyned to the Holy-bone [table 26, Figure 6, 7, [a]] the other at his end or beake, [table xxvi, Figure 7, [c]] ſometimes alſo between his firſt and ſecond bone,

Os Coccygis.

At the ſides of the lower belly there are twoe bones, whoſe vpper and broader parts committed to the Holy-bone, [table xxvi. Fig, 13. [A E CC DD] are called *oſſa Ilium*, [table xxv, Figure 1.[mm], table 26, Figure 13. aboue *T* at *ſ*] the hanch bone, and their circumference is called *Spina oſsis Ilii.* [table 25, Figure 1, 2, [ii], table 26. 13. [H L M N].] The lower and vtter parts of theſe bones are called *oſſa Coxendicis* [table 25. Figure 1.[nn] tab, 26, Figure

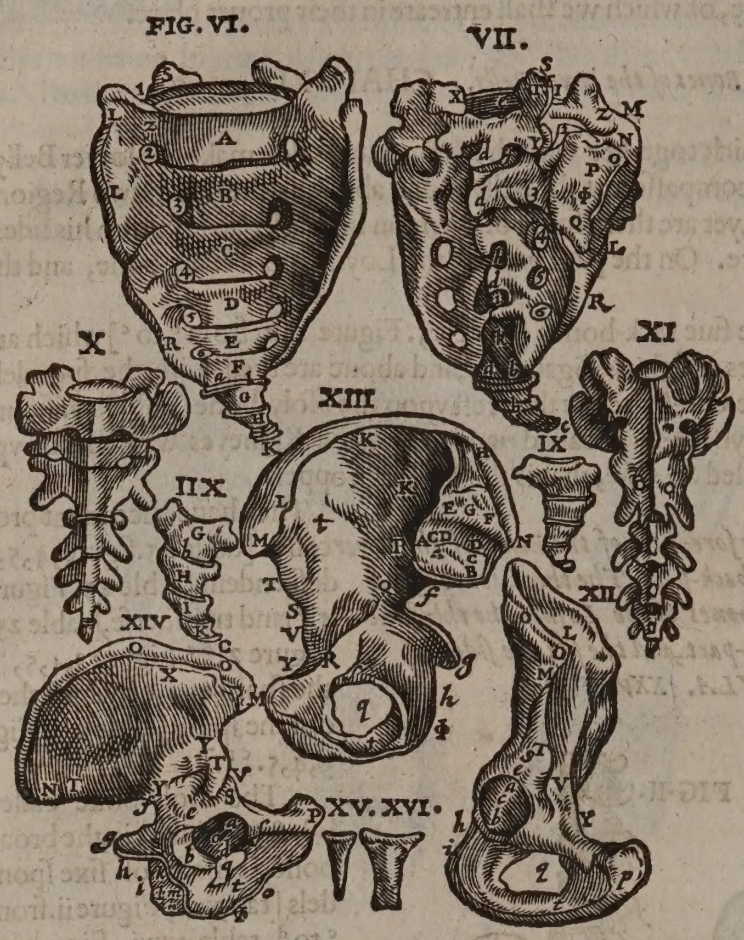
The bones on the ſides.

Oſſa Ilium.

Oſſa Coxendicis

The sixt Figure sheweth the fore-part of the Holy bone, together with the rumpe bone. The seuenth figure the back part. The eight the rumpe of a man. The ix. the rumpe of a woman. The x. and xi. the fore-part and back-part of the Holy & rump bones of an Ape. The xii. the foreside, the xiii, the inside, the xiiii, the outside of the great haunchbone, the xv the gristle betwixt the share bones of a man, the xvi. *the same in a Woman.*

TABVLA XXVI.



Os pubies.

Peluis.

Fig.xiii, below [r] and [f] vnto [x] and [p]] or the Hippe bone, which hath in it a notable boxe or cup [table xxvi, fig 12,14, [a b c]] whereinto the head of the thigh is copulated.

Finally, the bones in the fore-part of the lower belly are called *Ossa pubis*, [Tab: xxv, fig. 1,2, [pp]. Tab: xxvi, Fig: xiii, xiiii. that which is below [x] and [φ]] the Share-bones; they are tyed together in the middest of the share with a Cartilage [tab. xxvi, Figure. xv,] they are very thinne, and haue the greatest perforation of the whole body. [Table xxv. fig 1,2, [qq]. Table xxvi, fig. xii, xiii, xiiii, [q]] These bones, together with the Holy bone, make that *pelvis* or Dish which conteyneth part of the guts, the bladder, and the wombe, marked in the xxv. & Table in the first figure.

Of all which, wee haue heere giuen you but a view, reseruing the fuller Discourse vnto our Booke of Bones.

CHAP. XX. *Of the Brests or Paps.*

The reason why the Discourse of the brests is here placed.

ALthough the brests or paps are not conteyned in the lower Venter or compas of the *Abdomen*, yet as before the Gullet, so now these, because they be parts which serue chiefly for nourishment, wee haue thought this place fittest for their history. But because there is nothing so much vse of them in men as in women, therefore we will first intreat of the breastes or paps of women, and then of men.

Their Names

The Breasts therefore are called in Latine *Mammæ*, in Greeke by *Hippocrater* μαζὸς, by *Aristotle* μασὸι of μασέυω, which signifieth to seeke, because in them Infants seeke their nourishment euen by a naturall instinct: *Galen* cals them τιτθὰι.

What Creatures haue Breasts.

No creatures haue paps but such as can beget a perfect creature. And amongst those that haue them, none haue them set afore in the middest of their Chest but onely a man, and indeede this place is most fit for them. For being made for the milke sake which they containe, it behooued they should be seated in that place where soonest and with most ease, because of the neighbour-hoode of the heart which is the shop of heate, the blood might be altred and laboured thereinto; and where also the greatest quantity of the benigne and pleasant superfluity of the norishment may be gathered.

The scituatiõ.

Moreouer, this scituation serueth also for more conuenient suckling. For because the infant cannot go, it is necessary that it should bee embraced in the handes and armes of the Nurse; being so embraced it can apply it selfe to no place so fitly as to this; & out of doubt our wise Creator by this position of the brests did set a marke of distinction betweene man and

and beaſt, for beaſts do onely nouriſh their young, but afterwards neglect them: but men doe transfuſe out of their heart into their young ones στοργήν, that is, a naturall affection, which the Latines hauing not beene able ſhortly to expreſſe, haue called Pious loue, or piety. For the Mother doth not onely nouriſh her Infants, but embraceth them and kiſſeth them; and ſo loue being neuer forgotten, at length growes reciprocall and mutuall. But leaſt the heauy breaſts ſhould flagge downe too lowe becauſe a woman goes alwaies vpright, they are knit and tyed by their whole *baſis* or bottome to the bony part of the cheſt. They are two, (euen as the whole body almoſt is diuided into two partes) that like good handmaides they might ſerue their dame the wombe, which it ſelfe is as it were parted into two; for the Milke doth not come vnto the breſts, till the infant be throughly perfected. And that if there be two Infants, yet they may both at once haue wherewith to ſatisfy and nouriſh them; and therefore thoſe creatures which accuſtomably bring forth more young, haue alſo more dugges to ſuckle them with. But if there had beene but one faſtened to the middle of the Cheſt, neyther would the blood haue gotten ſo well to it, becauſe it ſhould haue had one continuated bone vnder it which we call the breaſt bone; and beſide the infant could not haue bin ſo handſomly applyed vnto it.

The piety of parents.

Why two.

Why not one

Their forme is ſomewhat round, they are hardiſh, and are ſeuered aſunder by a middle diſtance, and in virgins before they be fit to conceyue they are imperfect, ſo that ſcarſe any thing appeares of them but Nipples; but as they grow fitter and fitter for conception, they begin to ſtrut out, become hard and like pleaſant Apples, whereupon *Ariſtophanes* calles them μῆλα. They repreſent as it were a halfe bowle, and when they ariſe two fingers high, then commonly the monthly courſes begin to flow. In women that haue neuer conceiued, they remaine knit and as it were gathered vp, but they grow as the belly and infant in thoſe that be with childe. When the Infant is perfect and that the time of deliuerance draweth neere, they ſwell proportionably as much as the wombe: for there is great conſent betweene them by the mediation of veſſels, as we ſhall heare afterward. This conſent appeareth, when the infant in the wombe either is not well, (for if it be weake, the breaſts are full of milke before their time, ſayth *Hippocrates*) or periſheth. Neyther is it maruell, ſeeing their officies haue ſo great affinity, for the wombe was made to receiue the ſeede, and to perfect the creature, and the breaſts to nouriſh it, being brought into the worlde. Alſo when the infant begins to mooue, then beginne they to riſe, and the nipples to ſtrut: and moreouer the infant is lodged on that ſide where the breſt growes greater, whether it bee the right or the left.

Their Figure.

Their magnitude.

Howe the Breaſts ſhew the weakneſſe of the Infant.

In fat folke they are greater, and in ſome becauſe of their great weight they hang lowe downe, as it is common among the women of *Ireland*, who neuer vſe to tye vp their breſts. In ſome they grow euen to a monſtrous greatneſſe as long as they giue ſucke and fal afterward. In olde women they be long and flaccid or looſe, ſo that in extreame age the Kernels and the fat being conſumed, onely the skin and the nipples do remaine; ſometimes, in ſuch people they are knit wrinkingly vpward.

Iriſh women haue long and flagging Breaſts.

The parts of the breaſtes are externall or internall: without, they are cloathed with the Slough or Cuticle and the true skin, in the middle is the nipple, of which afterward: the internal, are the fleſhy Membrane or panicle, the veſſels, the kernelly ſubſtance and the Fat. The Membrane inveſteth their glandulous ſubſtance and their fat and knitteth them vnto the Muſcles vnderneath by certaine Fibres ſent thorough their ſubſtance, betweene which Membrane and the skin are the veſſels, the Glandules or Kernels and the fat diſperſed.

The parts of the Breaſts.

Their Veſſels are two ſorts of veines [table 27, αβ.] The firſt are *cutanious* proceeding from the branch of the Axillarie & Humerarie veins which often look very blew, eſpecially in women with child and in nurſes, and are diſtributed into the skinne of the Cheſt and into the breaſts. Their inward veines are about the rootes, which doe not ariſe from the trunk of the hollow veine at the *Diaphragma*, but when the hollow veine hath firſt attained to the heart and thence to the coller or patell bones, it lendeth two braunches accompanied with two Arteries downward through the whole Cheſt, and two veines from them are inſerted into the Paps, which therefore go ſo long a iourney that in them the bloud might be perfectly boyled; for as it goeth vpward it paſſeth by the heart, and againe deſcending it is mooued and wrought by the motion of the *Thorax* or Cheſt which helpeth his more perfect concoction; and theſe are called the *Mammarie* or Pap-veines and Arteries.

Their veſſels. Their outward Veynes.

Their inward Veynes.

The *Mammarie* deſcending veine commonly ariſeth one on each ſide from the trunke of the veine called *ſub clauia*, that is, the veine vnder the coller-bones which are called *cla-*

The mammary Veyne.

ues or *clauiculæ*, and is carried vnder the breaſt-bone cloſe by the griſtles of the ribs, & getting out of the Cheſt, is vnder the right muſcles of the *Abdomen* about the nauell inoculated by *Anaſtomoſis* with the *Epigaſtricke* veine (which ariſeth from the ſame braunch with thoſe which are propagated to the matrix and the necke thereof) which creepeth vpward vnder the right muſcles with certaine ſmall tendrils. From the *Mammarie* veine betwixt the fourth and the fift ribbes, ſometimes higher ſometimes lower, there are ſent certaine outward boughes through the middle ſpaces of the Cartilages which ioyne the ribs to the breaſt bone; in men for the nouriſhing of the interior muſcles; but in women (in whome ſometimes they perforate the very breaſt-bone it ſelfe) both for the nouriſhment of thoſe muſcles, as alſo to carry the matter of the Milke to the glandules of the breaſts in thoſe that giue ſucke and to nouriſh the breaſtes, for through them an infinite number of webs of veines are deriued, which nature hath endowed with faculty of Milke-making. By theſe veſſelles ſayeth *Bauhine* (although others are of other minds) is made the conſent betweene the wombe and the breaſts (which is ſo great that onely contrectation of them wil prouoke luſt) which are by them ioyned as it were together, ſo that when the Infant groweth in the wombe, certaine common veines ariſing from them both doe affoord it nouriſhment; and when the Infant is born, that attraction of bloud ceaſing which was ſtrong whilſt the Infant remayned in the wombe, all the ouerplus of bloud floweth towardes the breaſts, and the breaſts like cupping glaſſes doe draw and pul it backward and from below. For *Hippocrates* ſayth. The Milk commeth from the wombe to the breaſtes, which after the birth is to be the nouriſhment of the Infant; and when the woman hath brought forth, the beginning of the motion being once made, that is, if ſhe haue once giuen ſucke; the Milk is carried with full ſtreame to the breaſts. And this it doth not only voluntarily, but the Paps draw more bloud then their nouriſhment requireth: which traction or drawing is cauſed by the Infants ſucking, by the amplitude of the veſſelles, by the motion of the Pappes, and for the auoyding of vacuity or emptineſſe: for the veines being exhauſted by ſucking, doe draw bloud into themſelues on euery ſide.

The *Anaſtomoſis* of the mammary veines with the *Epigaſtricke*

The conſent betweene the wombe and the breaſts.

The milk cõmeth from the womb to the breaſts.

How it is that the breaſts draw more bloud then is needfull for their owne nouriſhment.

Hence it is that a woman cannot well at the ſame time haue her courſes and giue ſucke, and *Hippocrates* ſayth that milke is German Couſen to the menſtruous blood. But to ſpeak as the thing is; the bloud is not carried to the Pappes ſo much by reaſon of this conſent of veſſels, as that when the motion of the bloud from the whole body to the wombe ceaſeth, then the whole body exonerateth or emptieth it ſelfe into the glandules of the breaſtes. Wherefore their ſubſtance like that of a ſponge is very rare or porous, that they might bee able to receiue the greater quantity of liquor.

Why a milk nurſe hath not her courſes.

The mammary arteries.

The nerues of the breaſts.

There are alſo internall Mammarie Arteries from the vpper trunke of the great Artery, which doe accompany the veines and are ioyned with ſome branches of the aſcendent *Epigaſtricks*. It hath nerues from the ſinewes of the Cheſt which are carried through the skinne partly to the nipples; but the thicker nerue is that which commeth to the nipple from the firſt nerue of the Cheſt, and doeth communicate thereto exquiſite ſence, and is the cauſe of the pleaſure conceiued by their contrectation.

The *Glandules* of the breaſts.

The Glandules or Kernels (which they call in Latin *mamillæ* or *mammæ*, or rather glandulous bodies) which make the body [table 27. ♃♄,] or bulke of the Pap, are the greateſt of the whole body, white, and do not as in moſt of the other creatures make one body, but are many and diſtinct, ſpongious and rare or porous that they might better drawe the Aliment vnto them and conuert it into milke; of theſe one is the greateſt, placed vnder the nipple, and about it are ſet all the other ſmall ones which cleaue to the muſcles of the *Thorax* or Cheſt.

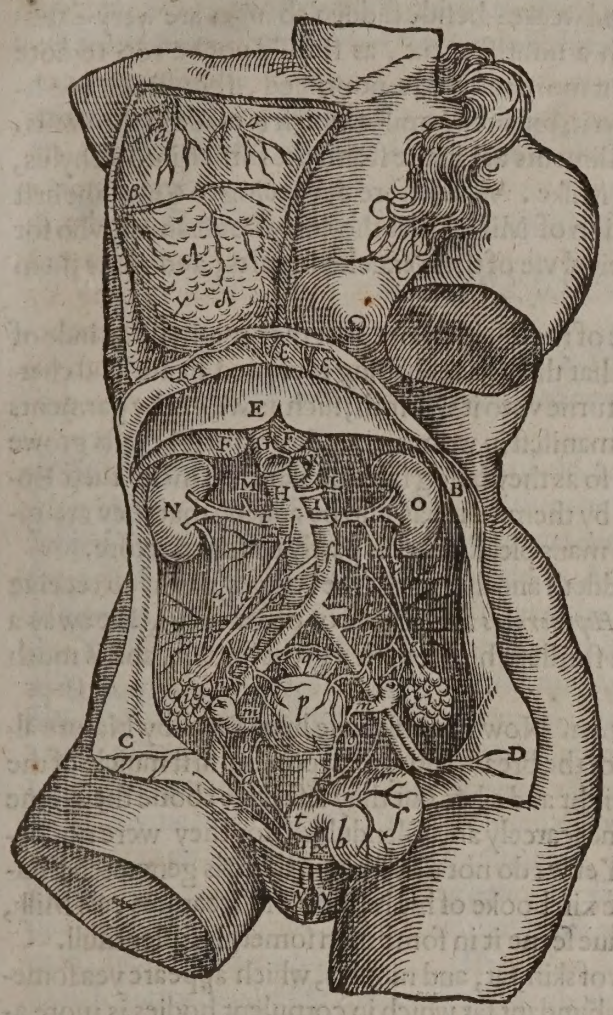
Among theſe are infinite veſſelles with many windings and turnings wouen together, that the bloud before in the veines and arteries perfected & receiued by the breaſts, might in theſe boughts and turnings through the glandulous bodies, bee conuerted into milke, which is a ſurpluſage of profitable Aliment.

Theſe Glandules in Virgins are hard, in women with Child eſpecially ſuch as haue giuen ſuck when they are ful of milke they ſtrut more, afterward they grow flacced and looſe, and are as it were conſumed. About theſe is a certaine fat diſpoſed, that it might cheriſh the heate of the veſſels and glandules and alſo make the breaſts equall. But that the milke that is ingendered in the breaſts might better paſſe out, the breaſtes are foreward acuminated or ſharpned, and that it might not runne at waſt but the Infant get it out by ſucking, they haue exceeding narrow and ſtraight outlets which are perceiued when the breaſt head

The ſmal outlets of the breaſts.

is

Tab. 27. sheweth the breast of a woman, with the skin flayed off. For the rest of the Table belongeth to another place.



a a. The Veines of the Paps comming from those veynes which are brought from the top of the shoulder to the skinne.

β The Veines of the Pappes comming from those Veynes which thorough the arme-hole passe into the hand.

γ The body of the pap.

δ δ The Glandules or Kernelles of the paps, together with the fat amongest them.

ε ε The Mammarie vesselles descending from the Patell bones vnder the brest bone.

is pressed that the Milke spinneth out, but especially when the Nipples are vlcerated in a woman that giueth sucke. And because the childe cannot take holde of the Pap it selfe to sucke out of it, therfore Nature hath prouided the nipples to stand out, as it were the heads and teates of the breastes, which the Infant may enclose with his lips, and lap his tongue about them, and so draw the Milke through the outlet or passage. But least this nipple or teate should euer and anon slip out of the childs mouth, it is made rough and rugous, and more vnequall then the rest of the skin. The Nipples.

Plato calleth it θηλὴ of θάλλειν to bud forth, in *Latine Papilla*, because it is like a *Papula*, that is, a pimple, whelke, or wheale. It is of a fungous or Mozy substance, somewhat like that of the yard, whence it is that by touching or sucking it groweth stiffe, and after will againe grow more flaccid or loose. In virgins this teate standeth not much out from the brest, & is red and vnequall, very like a strew-bery; in Nurses, because of the childes sucking, it groweth longer and blewer: in old folkes it is long and blackish. Why rugged.

About this teate is a circle, called in Latine *Areola*, in Greeke φῶς, we know no English name it hath, vnlesse we call it the ring of the Pap, but in Virgins it is pale or whitish, in women with childe and nurses it is duskish, in olde women blacke, and the skin more rugous and vnequall. The circle of the Teate.

From the disease of the Wombe it is also sometimes yellow, sometimes blacke. For *Hippocrates* saith, a man may iudge of the wombe by the colour of the Nipples, for if the nipple or his ring which was wont to be red grow pale, then is the womb affected. The colour of the nipples and the ring about them is also often made duskish and black by setting drawing glasses, drawing heades or such like vppon them to make them stand out that the Infant may take them, which may notwithstanding bee preuented if care be had. A good note for women. The euill euent of drawing glasses to the Nipples.

The proper vse of the breasts, is to be a Magazine or Store-house of meate for the Mothers owne childe, or, that in them so long milke should bee generated, as the Infant for his The vse of the breasts.

nouriſhment ſhould ſtand in neede of it. For whereas it was accuſtomed in the wombe to be nouriſhed by the Mothers blood conueyed vnto it by the vmbilicall veines, it cannot ſo ſuddenly change that liquid for more ſolid nouriſhment, for it could not digeſt it, becauſe when it is newe borne, it is but tender and weake; beſide ſudden changes are very daungerous, wherefore it had neede of ſuch a nouriſhment, as ſhould not be too remote from the nature of blood: and that it might more eaſily bee nouriſhed, ſhould alſo bee liquid, ſweete, and after a ſort familiar vnto it; but ſuch is milke which is made in the breſts. For ſo in growne men and women, the Aliments are in the ſtomacke turned into Chylus, which is a Creame or ſubſtance like vnto Milke. Wherefore according to *Galen*, the firſt and chiefe vſe of the breſts, is the generation of Milke, that they may be aſhamed, who for nicity and delicacie do forfeite this principal vſe of theſe excellent parts, and make them onely ſtales or bauds of luſt.

A Secondary vſe of them, is in reſpect of their ſcituation, that they might be a kinde of couering and defence for the heart, and that themſelues hauing receyued heate and cherriſhment from the heart, might again returne vnto it warmth, ſuch as we get by garments we buckle about vs; eſpecially this vſe is manifeſt in women, in whom theſe breaſts growe oftentimes into a great maſſe or waight, ſo as they being farre colder then men, their Entrals vnder the *Hypochondria* are warmed by them. It may alſo be added, that they are giuen for ornament of the Cheſt, and for a mans pleaſure, as is partly touched before.

Note this. *Hippocrates* in his booke *de Glandulis* addeth another vſe of the Pappes, that is to receiue excrementitious moyſture: for if ſayeth *Hippocrates* any diſeaſe or other euent, take away a womans Pappes, her voyce becommeth ſhriller, ſhe proueth a great ſpitter, and is much troubled with payne in her head.

The Paps of Men. And thus much of the Pappes of women. Now men likewiſe haue Paps by Nature allowed them, ſcituated alſo in the middle of the breaſt, and lying vpon the firſt muſcle of the arme called *Pectoralis*. They are two, a right and a left, but they riſe little aboue the skinne (as they doe in women) becauſe they haue ſcarcely any Glandules, for they were not ordayned to conuert or conteine milke. Yet we do not deny but in them is generated a humour like to milke, which *Ariſtotle* in the xii. booke of his hiſtorie of Creatures cals Milk, but it will not at all nouriſh, albeit we haue ſeene it in ſome men ſomething plentifull.

What humor is in them.

The Pappes of Men are compounded of skin, fat, and nipples, which appeare yea ſometimes hang forth in them becauſe of the abundant fat which in corpulent bodies is more about that place then in any part of the Cheſt beſide: the nipples of men are ſomewhat fungous and alſo perforated.

Their compoſition. They haue Veines, Arteries, and Nerues, for their nouriſhment, life and ſence.

Their vſe is to defend the heart as with a Target or Buckler; or it may bee ſayed, that they are giuen for ornament, that the breaſt ſhould not be without ſome repreſentation in it. The Nipples are the Center in which the veines and nerues doe determine, which alſo are therein conioyned.

Their Vſes. And heere we will put an end to the Hiſtory of Parts belonging to Nutrition or Nouriſhment, and proſecute our intent to diſcuſſe the Controuerſies and Queſtions vvhich may ariſe concerning them.

THE

A Dilucidation or Expoſition of the Contouerſies concerning the parts belonging to Nutrition

QVESTION I.

Whether the Guttes haue any common Attractiue faculty.

THE Phyſitians of old time haue beene at great difference among themſelues, whether the Guttes haue onely an expulſiue faculty, or all thoſe foure which ſerue as Hand-maydes to Nouriſhment, the Drawing, Reteyning, Aſsimulating, and Expelling. The occaſion of the ſtrife was giuen by certaine places of the Greekes and Arabians which were of doubtful conſtruction; for ſometimes they acknowledge thoſe foure faculties, ſometimes deny them. Our purpoſe is to skanne and fan this queſtion as near as we can, beginning our diſputation at the Attractiue or drawing faculty. But becauſe wee would not be puzled in the equiuocall or want way betwixt a Faculty and Action: it ſhall not bee amiſſe to ſticke downe ſome ſtakes, to lay ſome foundations for our better direction: ſuch are theſe.

Of Actions ſome are Common or Officiall, others Priuate or peculiar. The common actions were ordained either for the behoofe of the whole, or at leaſt for more partes then one. So the Liuer doeth ſanguifie the Aliment, not for his owne vſe alone, but for the nouriſhment of the whole body. The Heart and the Braine doe ingender Vitall and Animall ſpirits, to giue life and ſence to the whole man; not onely for their owne particular and priuate vſe. The ſtomacke chylifieth the meate, not for it ſelfe (though it take ſome pleaſure in it) but for the Liuer. The Spleene, the Bladder of Gall, and the Kidneyes, do not draw the melancholy iuyce, the fiery choler, and the whaey vrine for their owne nouriſhment, but to depurate and cleanſe the Liuer and maſſe of bloud: wherefore theſe Actions are called Officiall, becauſe they ſerue and miniſter vnto many.

Two kinds of actions. Common or officiall.

Priuate Actions or peculiar, are ſuch as ſerue onely for the conſeruation of priuate and peculiar partes. So the Stomacke beſide his Chylification hath alſo a particular Action whereby it intendeth his owne proper nouriſhment, drawing, reteyning and concocting bloud familiar vnto it ſelfe and expelling the reliques of the ſame. Theſe things are ſo notoriouſly knowne to all men that they neede no curious demonſtation.

Priuate or particular.

Another foundation to be layde is this; that for peculiar and priuate Traction and expulſion, there is no neede of the helpe of fibres, but onely for the common and officiall; becauſe the priuate is accompliſhed alwayes without locall motion, but the common with it either alwayes or for the moſt part. Bones, Griſtles, and Ligaments, doe draw and expell without any contraction of fibres; for who euer obſerued them to moue in their traction? But as the Load-ſtone although it moue not, by an inbred and occult proprietie draweth yron; and plants which ſticke immoueably in the earth, doe ſuck and draw out of the ſame earth a iuyce familiar vnto their nature: after the ſame manner the particular and ſingular partes of the body out of the maſſe of bloud by a proprietie of their owne, doe draw and drinke into themſelues a proper and peculiar nouriſhment. But the common and officiall traction or expulſion, becauſe they are almoſt alwayes made with locall motion doe therefore ſtand in need of the help of fibres. So the motion of the hart although it be naturall, yet is not accompliſhed without the helpe of fibres, for in his *diaſtole* or diſtention, it draweth by right fibres blood through the hollow veine into the right ventricle and ayre by the veynall Artery into the left; againe by the tranſverſe it expelleth ſpirits, blood and fumed vapors. In like manner the wombe by right fibres draweth the ſeed of man, and by tranſuerſe is contracted for the excluſion or birth of the Infant.

There is no need of fibres to the performance of priuate actions.

The state of the question.

These foundations being layde, the state of the question standeth thus. When it is demanded whether the Guttes haue any attractiue facultie, wee doe not enquire about the priuate and peculiar Attraction of the guttes for that is beyond controuersie, considering that life is sustained by nutrition, which is alwaies accompanied by those foure in-bred faculties, Attraction, Retention, Concoction, and Expulsion; but the question is concerning a common or official Traction, that is, whether the Guts haue power of drawing the Chylus from the stomacke. We thinke they haue not, and *Galen* fauoureth also our opinion; for in his bookes of the *vse of Parts*, he sayeth, *The Guttes stand not in neede of an attractiue facultie*, and againe, *The Guttes hauing no neede either to draw or to reteyne because their motion is simple, haue also but simple Fibres*; and in another place euery Gutte hath in each coate circular fibres, *For they are contracted onely but draw nothing*; the same also hee auerreth in his 6. booke *de Locis affectis*.

Galen.

There is no common Tractiue faculty in the guts.

3. *de nat. facult.*

Obiection.

But you will say, if the Guts draw not the Chylus, what power or faculty is it which bringeth the same vnto them? Doth the stomack driue out of it selfe so profitable an Aliment? We answere, *Galens* meaning is, that the Chylus is boyled in the stomack, and that the *Pylorus* or lower mouth all the time of concoction is closely shut vp, that nothing either thicke or thinne may be able to passe away before it be concocted, leuigated and perfectly laboured. When this concoction is throughly celebrated, then is the stomack delighted with the Chylus, imbraceth it a while, as being now become familiar vnto it; afterward Nature in a wonderfull prouidence openeth a certaine small membrane, and then the Chylus as it were an ouerplus or superfluitie, is driuen forth and falleth into the guts; in whose boughts and circles while it maketh stay, the thinner part like vnto creame is sucked away by the veines of the mesenterie; but the thicker by his waight falleth vnto the great guts, and by the circular fibres is thrust forth. Such is *Galens* true and sound Philosophy concerning this question, whereby we are taught that the Chylus is not *drawne* by the guts, but *driuen* into them by the stomacke.

Galen expounded.

The opinion of late writers.

Notwithstanding there want not many among the late writers, who perswade themselues that the guts, especially the small ones, haue this common Tractiue faculty inherent in them, and I am perswaded that they build their opinion vppon the authoritie and some light reasons of the Arabians. *Auicen* writeth that the Chylus falleth from the stomacke into the guts, by the helpe and assistance of two faculties; one expulsiue of the stomacke, and another attractiue of the guts; and this also he repeateth in his thirteenth booke *de Animalibus*.

Auicen Fen. 1. primi.

Their reasõs.

To this authoritie they adde a threefold reason: First, no man will deny but all the parts do draw a familiar iuyce vnto themselues. Now, the Chylus, say they, is the familiar Aliment of the guttes, by which they are nourished as the stomacke is. Againe, if the Chylus be onely driuen out or excluded by the stomacke, then is that motion violent; but it is absurd that nourishment should be made by force or violence, for then it would not endure; the nourishment therefore is drawne, not driuen. Lastly, the guttes haue right fibres extended in their length and those we know are onely prepared by Nature where traction is necessarie as being their proper worke.

Answer to the arguments.

But those arguments are so sleight and triuiall as a nouice may see their weakenesse as he runnes. For, first wee may not admit of that *paradox* which they obtrude concerning the nourishment of the guttes and the stomacke; for indeede the stomacke is not nourished by the Chylus, but only delighted with his presence, otherwise, for his nourishment, it draweth bloud by the *Gastricke* and *Coronarie* veines, which also it assimulateth as in due place we shall proue. And for the guttes neither are they nourished by the Chylus, but by bloud which is brought vnto them by the mesaraick veines; the guts therefore draw not the Chylus for their nourishment. Whereas they say that the motion of the stomacke driuing out the Chylus is violent, I thinke they are farre out of the way; it is rather Naturall becausse it followeth his contraction; against which the naturall forme of the Aliment, that is, his grauitie or waight doth not repugne.

Lastly, we altogether deny that which they affirme concerning right fibres, for in either coate of the guts there is onely one kinde of fibres and those circular; and if any right Fibres do appeare, yet is it not in the small guts which conteine the Chylus, but onely in the last which is called the *right gut*, in which the excrements are reserued for immediate euacuation.

But let vs grant, that in both the coates of the guts there are right Fibres, yet it follow-

eth

eth not that there is any such drawing faculty as they dreame of, for right Fibres are not alwayes ordained for traction. And this *Galen* doth excellently declare in his fourth booke of the vse of parts, where he saith, *That the right gut onely hath right Fibres allowed it, not for traction, but for preseruation of the transuerse.* For it was to be feared, least the circular Fibres should separate or be drawne asunder, vnlesse on the outside they had beenstrengthned by right, as it were by bands or ties; so the Coates of the Veines haue right Fibres not for atraction, but onely *ad συσπάθειαν* as wee say, that is to hinder an inconuenience. So Chyrurgions for the better reteyning in their due place circular bands, do strengthen them with right Ties or Deligations. And thus much shall be sufficient to haue saide concerning the attraction of the guts.

Right fibres are not onely ordained for traction. *Galen.*

QVEST. II. *Whether the Guts haue any common Retentiue Faculty.*

THE authorities of *Galen* aboue alledged do prooue but one faculty of the guts, to wit, the Expulsiue; yet there are some which striue out of *Galen* him selfe to prooue common and officiall-Retentiue and Concocting Faculties also. Concerning the Retentiue we will first see and then of the other. *Galen* discoursing about the nature and causes of the *Lienterie* (a disease wherein the meat is auoyded whole and vndigested as it was eaten, without any notable alteration) referres it to the weakenesse of the retentiue vertue; not of the proper Aliment that is of bloud, but of the Chylus contayned; the same also doth *Auicen* determine. Moreouer *Galen 3. de symptomat. causis* sayeth, that the concoctiue facultie in Children is stronger, but the retentiue and expulsiue weaker, because they haue tender bellies, or doe oftentimes vnburden nature; now those things that are auoyded are contayned in the guts, the retentiue faculty therefore of the guttes is the weaker.

Concerning the retentiue faculty of the guts. Arguments to proue it. *Galen. Auicen. Com. ad Aphor. 22. sect 3. ad Aphor. 12. sect. 4. ad Aphor. 1. sect. 6. ad Sent. 5. sect. 3. lib. 3. Epid.* alio 1. *de Crisib. 22. Fer. tract. 5. c. 5.*

Againe in his booke of experienced medicines he prescribeth stipticke or binding medicaments for the fluxe of the belly, to roborate or strengthen the vertue of the guttes; and wee in the *diarrhœa* doe apply outward strengthening and astringent things. Adde hereto that most men are somewhat bound rather then soluble, the cause of which astriction they referre vnto the strength of the retentiue vertue, out of *Galens* commentarie vppon the xx. *Aphorisme* of the second section. Lastly the retention of the Chylus and of the excrement is necessary; of the Chylus, that the Aliments should not suddenly slip away and wee thereby become slaues to our insatiable throates and paunches; of the excrements, least we should be constrayned continually and vnseasonably to auoyde them.

Galen.

These and such like things they propound, to teach that there is some force and power in the guttes to reteine the Chylus and the excrements, which because they seeme to bee very strange, and abhorring from the determinations of *Galen* and the ancient Physitians, it shall not be amisse to make interpretation of *Galens* wordes. The *Lienterie* is a disease not of the guttes but of the stomacke, and it is a *symptome* in the ouer hasty egestion or expulsion of meates scarcely at all altered or changed; for *Galen* thus defineth the *Lienterie*, *When the meate is auoided by the siedge not at all altered or concocted*; and therefore they doe ill that call it a *leuitie* or smoothnesse of the guttes, because it may be sometime when they are rough, being an affection of the stomacke onely and not of the guts; for although they be smooth and slippery, yet if the stomacke doe sufficiently boyle the Aliment, wee are neuer troubled with the *Lienterie*, because the nature of it consisteth *In the priuation of the first concoction*, which is celebrated in the stomacke, and in a heady or sodaine egestion; wherefore they conclude amisse that the *Lienterie* proceedeth from the weakenesse of the retentiue facultie of the guttes, for that *Galen* conceiteth not; who discussing the causes thereof, referres them to the distemper of the stomacke dissoluing the strength of all his faculties and to a light and superficiall exulceration, whereby that commeth to passe in the stomacke prouoked by the *Lienterie*, which hapneth in the bladder through the strangurie. It is true that the distemper of the guts do also breed a *Lienterie*, but not at the first hand, vnlesse the stomacke also doe sympathize with them, or bee drawne into consent by reason of their mutuall society communion and neighbor-hood.

The former arguments answered.

Galen expoũded. The nature of the *Lientery Galen.*

And whereas *Galen* writeth that Children are often troubled with vomitings and loosenesse, hee referres the cause thereof to the weakenesse of their retentiue vertue; not of the guttes but of the stomacke, for their fibres are softer; beside their liquid eiections are caused

Why Children vomit & scoure often.

by

by their continuall eating and greedy appetites, the ſtrength of their naturall heat deſiring more then it can conteine or concoct; whence it commeth to paſſe that the fibres, as it were the raynes of the ſtomacke being looſened, they are ouertaken with manifold vomitings and frequent deiections.

Thoſe things which they obiect concerning ſtipticke medicines which coroborate the guts, and ſtay the fluxe of the Belly are but of ſmall moment; for we doe not therefore apply them to ſtrengthen the Retention of the guts which is none at all, but to bind or Contract the veines of the meſenterie, which are diſperſed in infinite braunches through the coates of the guttes, and doe empty into them malignant and ſuperfluous humors; or elſe to thicken, refrigerate, or appeaſe thoſe raging humors which in ſubſtance are very thinne, in their Temper very hot, and in their quality very ſharpe and coroding; that ſo they might become more vnapt to moue with ſuch violence and force as they are wont. And what I pray you is more abſurde, then to referre the cauſe of the aſtriction of the belly to the ſtrength of the Reteining vertue? Let them rather harken to *Galen*, who in the third book of the cauſes of *Symptomes*, elegantly aſſigneth the cauſes of ſlowe deiection, ſometime to the weakneſſe of the expulſiue power, ſometime to the dull ſence of the guttes, ſometime to the thickneſſe, ſtipticke, or binding nature and ſmall quantitie of that which is eaten; ſometime to the weakneſſe of the muſcles of the *Abdomen*, who haue a great hand & beare a great part in the auoyding of the excrements; but concerning the Retentiue power of the guts he addeth not a word, neither maketh mention thereof.

The vſe of ſtipticke medicines in fluxes.

Galen. The true cauſes of coſtiuenes.

Laſtly, whereas they obtrude vnto vs, the neceſsity of their Retention of the Chylus and the excrements, we admit is very willingly; but doe not aſcribe it to the retentiue faculty of the guts: for toward the reteyning of the Chylus, the wiſedome and prouidence of Nature hath prouided the manifold boughts, doublings, and conuolutions or writhen complications of the guttes; ſo that in ſo long a iourney and intricate a paſſage, it is not poſsible that almoſt any part of the Aliment ſhould arriue at the port Eſquiline which before was not met withall by the ſucking mouthes of the almoſt infinite veines of the meſenterie. And for the Retention of the excrements, it is not a naturall but an Animall action; becauſe it is performed by the helpe of muſcles, to wit, the ſphincters, which doe conſtringe or gather together the lower part of the right gut, that the excrement might not bee auoyded without the commandement of reaſon and conſent of the will. It is therefore hence manifeſt that the guts haue no Naturall power to reteine the Chylus or the excrement.

The reaſon of the conuolutions of the guts.

The concluſion.

QVEST. III. *Whether the Guttes haue any Concocting Faculty.*

THat in euery Concoction there are three things neceſſarily required; a Preparation, the Concoction or boyling it ſelfe, and a Perfection after it, *Galen* is a plentifull witneſſe. So the preparation of the firſt Concoction is in the mouth, the Coction it ſelfe in the bottome of the ſtomacke, and the abſolution or perfection in the ſmall guts: the preparation to the ſecond Concoction is made in the veines of the meſenterie, the Coction it ſelfe in the *Parenchyma* of the Liuer, and the abſolution or perfection in the great veſſels. In like manner the ſeede atteineth a kind of rudement in the *Preparing veſſels*, but his *Idea* or form in the teſticles and his perfection in the *Paraſtatæ*. The Animall ſpirite hath a delineation in the wondrous nettes or webbes of Arteries, his forme in the middle ventricle, his abſolution in the latter ventricle of the braine; ſo that in the workes of Nature theſe manifold degrees of operations do euery where appeare.

Three things required in all concoctions

This Concoction of ſpirites or of Alement whether it bee priuate or officiall is performed without the helpe of fibres, onely by the aſsiſtance and inbred proprietie of our naturall heate, and therefore by *Galen* it is called *Alteration*, and by him not denyed vnto the guts, for ſo he writeth in his fourth booke of the vſe of partes: *The guttes though they were not ordained to Concoct the Chylus, but onely to containe and diſtribute it, yet becauſe Nature is neuer idle, it attaineth in the paſſage through them, a more perfect elaboration, euen as in the greater veſſels there is a certaine facultie of perfecting the bloud which was before made in the Liuer.* And this opinion of *Galens* doeth *Areteus* and *Auerrhoes* follow, which alſo is ſeconded by good reaſon: for the ſubſtance of the guts and the ſtomacke is all one, whether you regarde the Temper or the Couler or the frame and texture of their coates. Wherefore

Galen. 4. de vſu part & 3 de natu facult.

Aret. lib. 1 de cauſis et Signis Chronic morb. cap. 15.

fore the Chylus is concocted in the ſtomacke, and there attaineth the ſpecies and forme of Chylus, but as it ſtayeth in the convolutions of the guts, and the rugged foldes of their inmoſt coate, it acquireth alſo a further alteration.

I am not ignorant, that there is a new Paradoxe maintained by ſome, to wit, that the guts haue more power to concoct the Chylus then the ſtomacke, and that in the time of concoction, the *pylorus* is not ſhut, but that the Aliment not yet throughly boyled, falleth throughe the ſtomacke into the guts; and they inſtance in wounds of the *Hypochondria* & ſmall guts, whence (ſay they) doth iſſue a Chylus not yet perfectly concocted, & therefore it had not his forme or perfection in the ſtomack. A paradoxe.

Furthermore, in *Exomphaloſi* or the rupture of the Nauell, the meate paſſeth foorth not perfectly laboured; and in the heighth of Summer when we drinke ſmal drinke, we doe inſtantly feele the cold in our guts. We anſwere, that they do not perceiue that in the caſes inſtanced, the guts are ill affected, and the ſtomacke out of hand drawne into conſent with them, as well becauſe of their communion and ſimilitude of ſubſtance, as alſo becauſe of their vicinity: for *Hippocrates* in his Booke of humors hath this golden ſaying, *Thoſe partes which are neere Neighbours, or haue community of ſubſtance, are at the firſt hand and verie notably affected.* Obiection. *Exomphaloſis.* Anſwere. *Hippocrates.*

It is therefore no wonder that crude or inconcocted and liquid Aliment ſhould flowe from a wounded gut. I confeſſe that liquid things do ſodainely fall downeward, ſo alſo is their alteration ſodaine and quicke. But they can hardly be perſwaded, that the great abundance of meate deuoured by Rauen-ſtomackes and Trencher-friends can be conteyned in the ſtomacke alone, ſeeing *Hippocrates* ſaith, that the amplitude thereof exceedeth not fiue handfuls. But they muſt know, that the ſubſtance of it is Membranous, and is eaſily diſtended into all dimenſions: beſide, theſe great gourmandizers do not perfectly concoct the Chylus, becauſe the portall Membrane is looſed before due time by the weight of ſo great a quantity. We conclude therefore, that the Chylus is concocted in the ſtomacke & perfected in the ſmaller guts. Obiection. *Hippocrates.* Anſwete.

QVEST. IIII. *Of the Expulſiue vertue of the guts, and their Periſtaltick motion.*

THat all the guts haue their expulſiue faculty very ſtrong, not onely for the auoyding of their proper, but alſo of common excrements; is ſo manifeſt, that it needeth no demonſtration; as that wherein we are conuinced by the authority of learned men, by the ſtructure & frame of the guts themſelues, and by the neceſsity of this kinde of action. To repeate *Galens* words out of his ſixt Booke of the vſe of parts in many places, out of his Bookes *de locis affectis, & Naturalibus Facultatibus*, were to abuſe my owne time and your patience. In the ſtructure of the guts if it be well conſidered, we ſhall finde both coates wouen onely with circular and ouerthwart Fibres, ordained for expulſion. Authorities. *Galen.*

And if theſe things will not mooue the froward minds and headſtrong wits of men, yet the neceſsity of the action, which is the finall cauſe (and cheefe in Nature) muſt neceſſarily conuince them. For the excrements being of neceſsity to bee avoyded, the Facultie by which they are auoyded, muſt needs alſo be neceſſary; yea more neceſſary then the attractiue, Nature being euer more diligent to expel that which is noctious or hurtfull, then to attract that which is profitable or behooueſull; and that is the reaſon why in men that lye a dying, the expiration is ſtronger then the inſpiration, becauſe in expiration the fumed or ſmoaky vapour which is offenſiue to the heart, is thruſt out; in inſpiration ayre is drawne in, which is naturall and familiar vnto it. The expulſiue vertue therefore of the guttes, is ſtronger then the reſt. Arguments. The neceſsity of the expulſiue faculty. Why in the inſtãt of death the expiratiõ is greater then the inſpiration.

But all this while the maner of this expulſion is not manifeſted, which in the next place we will endeauour to make plaine vnto you. The excrements are expelled by locall motion; and this motion is double, one naturall another animall. The Naturall is proper vnto the guts, the Animal to the Muſcles of the *Abdomen*. I call that natural which is not voluntary, and that animall which is done with choyſe and diſcretion. The naturall motion, which the Ancients called περιϛαλτικὸν is accompliſhed by tranſuerſe and orbicular Fibres contracting the guts. And this naturall motion is againe double, *One According to nature, another Againſt nature*. The firſt is accompliſhed when the guttes doe contract and gather them- The motion of the Guts double. Naturall motion double.

themſelues from aboue downward, in which motion offenſiue humors, winde and excrements are driuen downe; the other quite contrary when the circular Fibres do gather themſelues from below vpward, which is called ἄνω εἵλησις: and in this motion the wind, the Chylus, and the excrements are auoyded by the vpper parts, nothing by the lower although ſuch euacuations be prouoked by ſharpe Cliſters. *Galen* ſaith, *This motion hindreth the wind from comming downward, yea it maketh it flye vpward.*

Galen.

Hippocrates acknowledgeth a threefold cauſe of this depraued motion, *Inflammation, a confirmed oppilation or ſtopping, & ſometimes a light exulceration.* Inflammations ſtreighten the paſſages, Oppilation altogether ſhutteth them. So then the excrements hauing no currant paſſage, the expelling faculty following firſt of al the order inſtituted by nature, beginneth her contraction in the vpper part, to expell the excrement downeward; and this it endeuoureth againe and againe, but being fruſtrated becauſe of the ſtreightnes or ſtoppage which oppoſeth her; ſhe inuerteth the order, and begins her contraction from below, and that with ſuch violence, that (alas the while) the Chylus & the excrements are thrown out by the mouth: ſo diligent and circumſpect is Nature to vnburden it ſelfe of that which is noyſome or offenſiue.

Hippocrates.

The cauſes of the depraued motion.

The manner.

Againe, a light exulceration may cauſe this depraued motion; as, when the gut is afflicted by the proritation or goading of the vlcer it tranſmitteth vpward ſuch things as would offend it, & as it were altring her ſail, beareth her courſe vpward againſt Nature, which before ſhe held downward. This *Periſtaltick* motion which is contrary to the naturall, thoſe haue miſerable experience of which are afflicted with the lamentable and odious diſeaſe called *Ileos* or *Meſereri mei Deus*, wherein the ſeate or fundament is ſo cloſed, that a Needle cannot be thruſt into it, and if any Cliſters bee with much adoo adminiſtred, they are incontinently ſuckt vp, the circular Fibres contracting themſelues from below vpwardes. This diſeaſe *Hippocrates* in his booke περὶ παθῶν, calleth a head-ſtrong, ſharpe, and daungerous affect.

The Ileos.

Hippocrates.

The naturall motion of the guts.

The manner of it.

The vſe of the midriffe in the auoyding of excrements.

There is another motion whereby the excrements are auoided, which is Animall & voluntary, wrought and accompliſhed by the helpe of the Muſcles of the *Abdomen*; which being contracted do preſſe and ſtraine the guts and ſo ſhut out the excrements, which motion is alſo furthered by the Midriffe and the Rim of the belly. For the eight Muſcles of the *Abdomen*, compreſsing equally the paunch and the guts, do alike & indifferently driue the excrements both wayes, as well toward the ſtomacke as toward the ſeate; it was needfull therefore that there ſhould be ſome aſsiſtant part which ſhould driue it downward & turne it from aboue, which office the Midriffe performes.

QVEST. V. *Whither Cliſters can paſſe vpward vnto the Stomacke.*

BEcauſe I haue ſometimes heard Phyſitians diſputing about the aſcent of Cliſters, and haue read *Galen* and *Rhaſis* their contrary determinations concerning this matter, I haue thought it fit a little to diſcuſſe the queſtion in this place, the rather becauſe the truth may be demonſtrated by Anatomicall Euidence. *Rhaſis* is of opinion, that Cliſters may aſcend vnto the ſtomacke, and are often caſt out by the Noſethrils, his words are theſe. *If a Cliſter bee vvith great force and violence ſhot vp, it will ariue at the Stomacke: if it bee put vp gently and by degrees, it ſcarſe reacheth aboue the great guts.* *Galen* on the contrary iudgeth, that though the Liquor be neuer ſo forcibly driuen vpward, yet it will ſcarſe reach vnto the empty gut. For in the firſt Booke of his Method, he cureth Vlcers of the Lunges, Cheſt and Stomacke by Medicines taken at the mouth: but the vlcer of the guts, both by things taken at the mouth, and alſo iniected at the fundament with this difference, that if the vlcer be in the great guts he vſeth rather Cliſters; if in the ſmall, then he ſticketh more to Medicines at the mouth. The like he repeateth againe in the 13. of his Method, and to him wee rather liſten in this caſe then to *Rhaſis*; for I haue obſerued that the guts are ſeuen times as long as the body of the man whoſe guts they are, and *Hippocrates* meaſureth them to be thirteene cubites; and yet that is not all, for the manifold girations or convolutions whereinto they are circled do breake the force of any iniected liquor.

Rhaſis opinion 9. *Continentis.*

Galens opinio.

The great length of the guts.

I thinke therefore that ſuch liquors do not reach aboue the blinde gut. For proofe heereof ſaith *Laurentius*, I will tell you that which haply few hitherto haue obſerued. Let the

the guts bee dryed and blowne vp a little, and poure ſome water into the gut called *duodenum* and it will preſently iſſue out at the right gut; but on the contrary if it be powred into the right gut it wil ſtay in the appendix of the blind gut becauſe it can can get no farther; which proueth that in the end of the blind gut there is a value which Nature in great wiſedome hath ſet to hinder the refluence or returne of the excrements and vnprofitable humors, ſuch an one as appeareth in the paſſage of the Choler into the Guts & in the veſſels of the heart.

Laurentius his inſtance that Cliſters cannot paſſe vp to the ſtomack. The values of the guts

But it will be obiected that *Galen* in his third booke of the Cauſes of *Symptomes* ſayeth, *That ſome haue had Cliſters ſo giuen them, as they haue beene caſt vp by the mouth*; euen as the *fæces* or excrements in that miſerable diſeaſe called *Ileos* or *volvulus*. Wee anſwere that *Galen* here doth not contradict himſelfe: for it is one thing to ſpeake of the ſtomacke when it is well affected, and another when it is ill affected. For if the ſtomacke bee well affected the liquor can neuer ariſe vnto it, but if it be ill affected or affamiſhed, as in the diſeaſe called *Boulimos*, it draweth from below not onely ſuch humours as are iniected by the fundament but alſo the excrements themſelues. For as the pined or greedy Liuer draweth from the veines crude and vnconcocted iuyces, ſo is it with the ſtomacke, yea with the mouth: for we ſee what riffe raffe and what odious viands hunger maketh toothſome to ſuch as are pinched therewith.

Obiection.

Anſwere, and *Galen* expounded.

The force of hunger.

Againe, if the naturall motion of the guttes bee depraued, the circular fibres gathering themſelues from belowe vpwarde may make a Cliſter or other liquor aſcend vnto the ſtomacke. If it be obiected that nouriſhing Cliſters are carried vnto the Liuer, I anſwere that they ariſe not thither either of their owne accorde, or by the violence of the liquor iniected, but they are drawne by the veines of the meſenterie and thence tranſported into the Liuer.

Another cauſe that draweth liquor to the ſtomacke. How nouriſhing Cliſters come to the Liuer.

QVEST. VI. *Of the Euill Sauour of the Excrements.*

MAny men that are but ſleightly ſeene into the courſe of Nature, doe wonder much why in a ſound body and in a Temperate man the excrements of the Belly become ſo vnſauourie and abhominably ſented, becauſe all ſtench is the conſequence of corruption; and corruption or putrifaction hath for her efficient cauſe outward and acquired not inbred heate.

Of the ſauor of excrements.

For whoſe better ſatisfaction we ſay that Phyſitians acknowledge a double cauſe of this *fœtor* or ſtench, an Efficient and a Materiall. Concerning the efficient they ſay, that our heate though it be one in regard of the ſubiect, yet in different conſiderations it is diuerſe, and may be two wayes conſidered, either ſimply as it is heate, or elſe as it is inbred heate and the inſtrument of all the functions of the ſoule. As it is heate, it continually feedeth vpon and conſumeth the moiſture, as it is inbred it boyleth or concocteth, aſsimulateth and ingendreth; ſo from the ſame heate doe flow diuerſe yea contrary motions.

A double cauſe of it. The efficient cauſe is heat.

Whileſt the Chylus is made in the ſtomacke, the naturall or inbred heate inſinuateth it ſelfe equally and a like into all the parts of the matter; gathereth together thoſe thinges that are correſpondent to our nature and ſeparateth the reſt: the firſt are drawn away into the Liuer by the veines of the meſentery, but the other which cannot bee aſsimulated are thruſt downe into the great guttes, and there as vnprofitable are forſaken by the naturall heate; wherefore the heat worketh vpon it no more as it is inbred or direct from the ſoule, but ſimply as it is heate taking the nature of an outward heate, and thence comes the ſtench. Adde hereto the fitneſſe of the matter; for theſe ſuperfluities are crude and verie moyſt whence comes putrifaction; but if the humour bee drawne away the putrifaction is leſſe, and the ſauour not ſo noyſome.

And this is the only reaſon why the excrements of a man moſt temperate, haue a worſe ſauour then thoſe of other creatures; becauſe a man vſeth very moyſte nouriſhment and very diuerſe, that is of ſeuerall kinds, and leadeth a life more ſluggiſh and ſedentarie: other Creatures feede vppon dryer Fother and ſo their excrements become dryer. And this cauſe *Ariſtotle* aſsigned in his *Problemes*: where asking the queſtion why the excrements of the Belly the longer they are reteined are leſſe vnſauourie, and on the contrary the vrine the longer it is kept ſmelleth the ſtronger, he reſolueth it thus. Becauſe ſayeth hee, in the long ſtay, the excrements are dryed, and ſo the nouriſhment of putrifaction is ſubtracted or drawne away, which is not ſo in the vrine.

Why the excrements of men are more ſtinking then thoſe of other creatures. *Ariſt. Probleme ſect. 13.* A probleme.

Now

Now the reaſon of the forme and figuration of the Excrements, is becauſe of the Chambers and cels of the Collicke gut, wherein it ſwelleth into round & broken peeces.

QVEST. VII. *Of the ſubſtance and the ſcite of the guts.*

Galen.

What the ſubſtance of the guts is.

BEfore we paſſe from the guts, it will not bee amiſſe to reconcile ſome different places of *Galen* concerning their ſubſtance. In his Bookes of Method he ſaith, that if the guts be wounded or vlcerated, they do very hardly ioyne togither againe, eſpecially the ſmaller, becauſe their ſubſtance is neruous and membranous: but in the 14. Booke of the Vſe of parts, he writeth, that *the Guts and the Stomacke becauſe they are Inſtruments of concoction, haue a fleſhy Compoſition.* And the ſame *Hippocrates* inſinuateth in his *Aphoriſmes*, wher he ſaith, *That if vpon a Dyſenterie or bloody Flixe little Caruncles or ragges of fleſh doe paſſe away by ſeidge, it is a mortal ſigne.* The trueth is, that the ſubſtance of the guts is neruous or ſinnowy, but yet throughout alſo repleniſhed with fleſhy Fibres, ſo as it may bee ſaide to be both Membranous, and alſo fleſhy. Like as *Galen* calleth the wombe ſomtime a Membranous, ſometime a Fleſhy part.

Hippocrates. Aphor. 26 ſect 4

Certaine places of *Galen* & *Hippocrates* reconciled.

The errot of the Ancients about the ſcituation of the guts.

Concerning the ſcite or poſition of the guts, the Ancients ſeem to haue erred, becauſe they thought that the great guts did occupy the lower part of the belly, and the ſmaller the vpper: but the truth is, that the Colon which is the greateſt of all the reſt, runnes vp vnto the hollowneſſe of the Liuer, and the bottome of the ſtomacke; but the Ileon is extended downward vnto the Share bones. I conceyue that the Diſſection of Dogges and foure-footed Beaſts deceyued them. *Galen* himſelf ſpeaking to the capacity of the common people, calleth the great guts the lower, the ſmall guts the vpper, yea and many Phyſitians at this day are miſtaken, diſtinguiſhing the Dyſentery of the ſmal guts from that of the craſſe or thicke, by this, that if the paine be in the vpper parts then the diſeaſe is in the ſmal; if in the lower, then in the great guts.

Galen. Com. in 3 Epid.

Diuers opinions.

Concerning the ſcituation of the Collick gut, there are diuers opinions; ſome do therefore thinke it aſcendeth vnto the bottome of the ſtomacke, that by his contaction as alſo by that of the neighbor parts, the concoction of the ſtomacke might be furthered; others imagine, that it is therefore conueyed to the hollow of the Liuer, where the bladder of gal is ſeated, that the expulſiue faculty of the Colon, which lyeth as it were aſleepe, might by the ſweating yſſue of choler be better awaked and ſet on edge.

Different conceits about the aſcending of the Colon.

Another ſort there are who imagine, that the Colon giueth way to the ſmaller Guts, walling them about in manner of a fence or rampert, comming not neere the center of the Meſenterie, and that therefore it taketh vp the left ſide of the body, that the greater branch of the Port-veine called *Meſentericus*, might with a ſhorter cut be inſerted into the guts and carrie or transferre the meate vnto the Liuer by a nearer way.

Some there are, who thinke that the Colon adhereth or cleaueth to the bottome of the ſtomacke and hollow of the Liuer, that by their contaction the remainder of the Aliment which ſtayeth in the chambers of the Colon, might receiue more perfect concoction. Moreouer, they giue this reaſon of his ſcituation aloft, that that part of the Chylus which is therein contained might not ſo ſoone paſſe away, and ſo there might be more perfect & accompliſhed exſuction of the creame, for which cauſe alſo the cels and chambred conuolutions of the Colon, as alſo the blinde gut were ordained.

Why the preſsing of the Spleene makes melancholy bodyes to auoid wind downward.

This Collick gut is indeede the largeſt or moſt ample of all the reſt, but where it toucheth the Kidnies and the Spleene it becõmeth narrower, leſt it ſhould compreſſe the ſpleen, whence it comes to paſſe, that thoſe whoſe Spleens do ſwel or be notably ſtuffed, can hardly auoide any winde downward, vnleſſe the Spleene bee preſſed.

And thus much concerning the difficulties or curious queſtions about the guts, wherein we haue beene ſomewhat more prolixe, that ſuch as delight in the contemplatiue part of Anatomy, might not go away from vs altogether vnſatisfied. The ſtomack followeth.

QVEST.

QVEST. VIII. *Whither the vpper mouth of the ſtomacke be the ſeate of Appetite.*

SEeing the liue-tide of euery creature is inconſtant, and like a poaſte paſſeth ſwiftly away; becauſe of the continuall effluxion or expence of the threefold ſubſtance wherein it conſiſteth, Nature being vigilant and carefull about her owne preſeruation, endeuoureth continually to make vp the breach by Reſpiration and Nouriſhment. By reſpiration the ſpirituous, by nouriſhment the fleſhy and ſolide ſubſtaunce is reſtored. And hence it is that our nouriſhment is threefold, *Aer*, *meate*, and *drinke*. But becauſe there can be no nouriſhment without Appetite, nature hath diſpenſed to euery part a certaine deſire, whereby as by goades they are pricked forward to draw and ſucke into themſelues conuenient and familiar Aliment. But this deſire in the particular parts of the body is without ſenſe, for they feele not neyther perceiue when they draw or ſucke ſuch conuenient aliment. Wherefore, leaſt the parts ſhoulde pine away when they are exhauſted and as it were hunger-ſtarued, nature hath framed one part of exquiſite and perfect ſenſe, which alone fore-apprehending the ſuction and ſo the want of the reſt, ſhould ſtirre vp the creature to prouide and cooke their nouriſhment for them. For if the ſenſe of this ſuction or traction were in euery part, then in the time of affamiſhment or thirſt they would perpetually languiſh, & ſo the creature leade his life in a perpetuall diſeaſe.

The reaſon of our threefold nouriſhment.

The vpper mouth of the ſtomacke the ſeate of appetite.

This part ſo by nature ſet out, is the vppermoſt mouth of the ſtomacke, which the ancient *Græcians* as *Galen* witneſſeth, called καρδίαν. And all men doe concurre, that in it the Animall appetite and hunger, which is nothing elſe but a ſenſe of ſuction, haue their peculiar reſidence. And this ſenſe is exhibited in this place by two notable nerues called *Stomachici*, or the *Stomacke Nerues* ariſing from the ſixt paire or coniungation of the Braine.

Galen.

But after what manner this Animall appetite is ſtirred vp, *Galen* hath elegantly taught vs in his firſt Booke of *the cauſes of ſymptoms*. For the better vnderſtanding of which place, theſe things are firſt to be obſerued, that the animall appetite is double; one naturall, another depraued: to the firſt, theſe fiue ſignes or ſymptoms muſt neceſſarily concurre: firſt, an exhauſtion or deepe expence of the ſubſtance of the parts, next there muſt bee in the ſame parts a ſuction or traction; for the exhauſted parts do draw from their next neighbors and thoſe from others, till by continuation it do come to ſome extreame; which extreame is the vpper mouth of the ſtomacke where the traction ceaſeth: from this traction ariſeth the third ſigne, which is a diuulſion or kinde of violence offered to the mouth of the Stomacke, which diuulſion or violence ſtriketh the nerue; whence commeth the ſenſe, and from the ſenſe the appetite.

The Animall appetite double.

5. ſignes or Symptomes required to appetite.

In the depraued appetite, the ſame order and degrees of Symptoms are not obſerued. For in the diſeaſe called *Boulimos*, there is hunger without appetite, and in the Dog-appetite, there is appetite without hunger. In the *Boulimos* all the parts being exhauſted or hunger-bit, do draw from the ſtomacke, which on euery hand is torne and as it weee launced, yet doth not that diuulſion ſtrike the ſenſe, and ſo no appetite followeth; in the meantime the other parts being defrauded of their aliment, doe waſt away and conſume. The cauſe of this inſenſibility is the refrigeration of the nerue, the obſtruction of the ſame, and the exolution or fainting away of the appetitiue Faculty.

What *Boulimos* is.

On the contrary, in the Dogge-appetite there is no Inanition or emptineſſe of the parts, but an exquiſite ſenſe of ſuction, by reaſon of a coole and ſowre humor there impacted, and it is cured *Theorexi*, that is, by drinking of wine as *Hippocrates* witneſſeth. Hence therefore it is manifeſt, that the animall appetite is ſtirred vp in the mouth of the ſtomack, which is endued with ſo exquiſite ſenſe, that it is called the Organ or inſtrument of touching by *Hippocrates* in his Booke *of the Inſtruments of ſmelling*.

The cauſe of the dog appetite.

Hippocrates. Apho 21. *ſect.* 2

Hippocrates.

There remaineth yet one ſcruple, how the appetitiue faculty ſtanding in reference to the ſenſitiue, ſhould haue his ſeate in the mouth of the ſtomacke, ſeeing it is of al hands determined that the ſeate of all the animall faculties is in the braine. The anſwere is eaſie and at hand, to wit, that the faculty it ſelfe is in the braine, but the worke, efficacy, and action thereof in the ſtomacke. So the faculty of ſeeing is in the braine, but the ſight is accompliſhed in the eye. The moouing Faculty is likewiſe in the braine, yet is the Muſcle the immediate organ of voluntary motion.

Obiection.

Anſwere.

Obiect. If any man obiect that the Liuer is the ſeate of the appetetiue faculty; wee anſwere that the appetite reſiding in it is concupiſcible and without ſence, and not ſenſitiue at all. But we muſt not here forget that though this appetite of the ſtomacke bee with ſence, yet it is not ioyned with knowledge or diſcretion.

Anſwere.

Caution.

QVEST. IX. *Of the ſcituation and conſent of the vppermoſt mouth of the ſtomacke.*

THE difference or controuerſie concerning the ſcite of this Orifice is neither light nor vnprofitable, becauſe the reſolution thereof ſtinteth the ſtrife among the Phyſitians concerning the application of Topicall or locall medicines.

All men doe agree that it inclineth rather to the left hand then to the right, but the queſtion is, whether it bee nearer the ſpine of the backe, or the griſtle and blade of the breaſt. Some thinke that Nature framed this griſtle to be a defence for it and for no other cauſe, and therefore hath placed it there-under: for ſay they, thoſe that vomit or reach for it, doe finde a paine at this griſtle and none at the ſpine or racke of the backe. And *Hippocrates* conceiueth that the extuberation or diſtention of the ſtomacke at the *orifice* is not backeward but forward; whereas he ſayth, *That the repletion of the ſtomacke is a direction for broken ribbes.* Wee with *Galen* doe aſſigne the place of this *orifice* to bee in the left part toward the ſpine, not that it lyeth or reſteth vpon it as the gullet doeth, but becauſe it commeth nearer to the ſpine then to the breaſt-blade. And therefore it is that when the gullet or the vpper *orifice* are affected; we thinke it fit to apply locall medicines both to the backpart and to the fore-part. That that was propounded concerning the paine of them that reach to vomit, and the direction for the ribbes, is to be referred to the bottome, and not to the vpper mouth of the ſtomacke; for as we haue obſerued, the meate which wee eate is not conteyned in his mouthes or *orificies* but in his cauitie, which wee doe not deny doeth rather leane to the breaſt-blade then to the ſpine.

The ſcite of the vpper orifice.

Hippocrates. Lib. de articulis ſect. 3.

Where to apply local medicines.

But the reaſon why the breaſt bone is payned when the vpper orifice is affected is meerly Anatomicall; the midriffe being tyed to the bone, and the mouth of the ſtomacke adhæring to the large paſſage made in the midriffe for his conueyance thereout; and therefore the breaſt-blade is payned by this continuity, becauſe paines are rather felt in the extreamities or ends then in the middeſt, as is to bee ſeene in ſtreatched membranes. Concerning the ſympathy or conſent of this orifice with the heart and membranes of the brain *Hippocrates* and *Galen* are very plentifull; for this mouth being affected, the ſyncope or ſounding, the exolution or fainting of the ſpirits, and ſuch like *ſymptomes* doe ouertake vs as when the heart it ſelfe ſuffereth violence, whence this part amongſt the ancients as wee ſayd before, is called καρδία. In wounds of the head, the skull being either broken or ſhiuered, and the *Dura meninx* or thicker membrane of the braine expoſed or layde open to the ayre, which is vncouth or ſtrange vnto it, the Patient preſently vomiteth yellow and *Aeruginous* or greene choler, becauſe the ſtomack by reaſon of ſocietie, is drawne into conſent and ſympathizeth with the membrane, as well becauſe of the ſimilitude and likeneſſe of the ſubſtance, as alſo of the community of veſſels, which are the chiefe cauſes of conſent or ſympathy; as *Galen* obſerueth in his *Commentaries* vpon the firſt ſection of the 3. Booke of *Hippocrates Epidemia.*

The reaſon of the paine at the breaſt bone, when the mouth of the ſtomack is affected.

The conſent of the mouth of the ſtomack, with the heart and the braine.

Why vomitings follow the wounds of the braine. *Galen.*

QVEST. X.

Whether the Chylus be made by the heat, or by the forme of the Stomacke: and why the ſtomack doth not breede foure ſubſtances and excrements as well as the Liuer.

THE remouing of theſe two obſtacles and diſſolution of the doubts ariſing in them ſhall neede no great curioſity; the firſt wee will determine thus. The Chylus is formed not ſo much by the power of the heate, as by the ingenite property of the ſtomack. True it is that all concoction is accompliſhed by the help and aſsiſtance of heate, and therefore Nature hath prouided that the ſtomacke ſhould be cheriſhed and comforted on euery ſide, aboue and below, on the right hand and on the left, before and behinde; but this concoction belongeth not to the heate as it is heate (for by that reaſon fiery and aguiſh heate which corrupteth all thinges, ſhould be

Why the ſtomacke is incompaſſed with warme parts.

be the cauſe of concoction) but as it is the inſtrument of the ſoule. But that which wee call chylification or making of the Chylus, proceedeth alone from the forme and proprietie of the ſtomacke, becauſe in other parts ſauing this, the naturall heate though it be very ſtrong and intenſe yet doth not chylifie. Now why the ſtomacke as the Liuer doeth not beget or breede foure kinds of ſubſtances, there may bee a double reaſon aſſigned; one from the matter, another from the efficient.

A double reaſon why the ſtomack breedeth not 4. ſubſtances.

The Efficient or working cauſe is naturall heate, which if it be very ſtrong, it powerfully and effectually or really ſeparateth *Hetrogenia*, that is partes that are vnlike or of different natures. But all men know that the Liuer is ſo much hotter then the ſtomacke, as bloudy parts are hotter then thoſe without bloud; for the Liuer is a fleſhy bowell and the ſtomack a membranous: wherefore the heate of the Liuer diuideth the Aliment into more particles, which the weake heat of the ſtomacke cannot doe.

The firſt frō the efficient.

To this efficacy of the Efficient may be added as we ſayd the diſpoſition of the matter; for liquid things are more eaſily altered then ſolid: nowe the ſtomacke receiueth the Aliment when it is ſolide which with great labour it boyleth, breaketh, and altereth; but the Liuer receiueth it already, attenuated and wrought vnto an equality when it is no great labor to ſeparate the diſimilar and *Heterogenie* parts, or being ſeparated to driue them into their proper receptacles.

The 2. from the diſpoſition of the matter.

QVEST. XI. *Whether the Stomacke be nouriſhed by the Chylus or by Bloud.*

FInally, that we may paſſe from the ſtomack, we will end with that great controuerſie which is amongſt Phiſitians concerning his nouriſhment. Some there are who thinke that the Stomacke and the Guttes are nouriſhed by the Chylus, ſome by crude or raw bloud not laboured in the *Parenchyma* or ſubſtance of the Liuer; but onely hauing an inchoated mittigation in the braunches of the port or gate veine.

Diuers opinions about the nouriſhment of the ſtomacke.

Auicen thought that the vtter coate was nouriſhed with bloud and the inner with Chylus. *Zoar* writeth that the vpper or neruous part is nouriſhed with the Chylus, and the lower which is more fleſhy, with bloud. We with *Galen* determine, that the whole ſtomack as all other membranes is nouriſhed with pure bloud, which hath had his vtmoſt and perfect elaboration in the Liuer. For the proofe whereof beſide the vulgar and ouerworn arguments which Phyſitians vſe, theſe of no light moment may be caſt vnto the heape.

Auicen. *Zoar.* *Galen.*

The firſt is taken from Diſſection, becauſe through all the coates of the ſtomacke and his two orificies, there appeare notable and aboundant veines diuerſly diſperſed, which doubtleſſe were not idely or in vein ordayned by Nature, neither yet to tranſport the Chylus to the hollownes of the Liuer, howſoeuer *Bauhine* be conceited, (vnleſſe happely in extreamity of hunger) for then they ſhould carry it rawe, not yet hauing receiued his perfection in the guts.

1. Reaſon.

Moreouer if the veines were eſpecially appointed for the tranſportation of the Chylus, it being made rather in the bottome then at the ſides or top of the ſtomacke, there ſhould haue beene more veines and more conſpicuous in the bottome then in the top, which experience teacheth vs to be otherwiſe; for the whole baſis and circumference of the vpper mouth is incompaſſed with an ample veſſell called *Coronaria ſtomachica* or the garland vein of the ſtomack, becauſe the coats of the orifics are thicker then thoſe of the bottome, and therefore neede more plentifull Aliment. We reſolue therefore that theſe veines were ordained for the nouriſhment of the ſtomacke; but wee will vnder-prop this reaſon with a ſtronger.

In the Chylus although it be laudable and well diſpoſed, yet there remaine ſome vnprofitable and excrementitious parts; to wit, Choler, Melancholy, and whay or vrine, which cannot be ſeparated or purged there-from but by the heate of the Liuer. Now nothing can nouriſh perfectly vnleſſe it be cleanſed from thoſe recrements: how therefore ſhal the Chylus not yet defœcated, be ſayd to be conuenient Aliment for the ſtomacke? And this *Galen* ſeemeth to intimate when he ſayth; *That nothing can perfectly nouriſh which hath not paſſed through all the concoctions.*

2. Reaſon. *Galen.*

A third argument to proue our aſſertion, that the ſtomacke is nouriſhed by blood, is becauſe thoſe creatures that mew themſelues vp all winter in holes and rockes and ſuch ſecret

3. Reaſon.

places are nouriſhed by blood, and not by Chylus, becauſe al that time they feed not at al. The infant likewiſe as long as it is conteined in the womb, hath his ſtomacke without controuerſie noriſhed with pure blood brought vnto it by the vmbilical vein. Hereto *Valetius* in his Controuerſies anſwers, that the Stomacke is nouriſhed by the more crude or rawe part of the Mothers blood which is not much vnlike vnto Chylus. But as well might he ſay, that the Braine, the Bones, and al the Membranes haue their refection there from, becauſe they are nouriſhed with Flegmatick and crude blood.

Valetius diſproued.

Furthermore, in great weakeneſſe of the ſtomacke and loathing of meate, that the patient ſhould not vtterly conſume, wee preſcribe nouriſhing Cliſters of the beſt ſortes of fleſh, Capons, Patridges, and ſuch like boyled to a broath. This liquor ariueth not at the ſtomacke, but is ſuckt away by the Veines of the guts, and tranſported to the Liuer where it attaineth the forme of bloode, and after being carried in the veines as in water-courſes vnto the parts, it watereth, nouriſheth and refreſheth them. Nowe who will ſay; that at this time the ſtomacke is nouriſhed by Chylus when there is no chilification therein: and yet I hope they will not deny that it is then alſo nouriſhed as well as the other parts. Finally this opinion of ours may bee demonſtrated by the ſimilitude or correſpondencie of the nouriſhment of other parts like vnto it; and therefore ſeeing all the membranous parts of the body are nouriſhed by blood, why ſhould the Stomacke among all the reſt bee exempted? We do therefore conclude, that the Stomacke is nouriſhed by blood, and that not onely hauing an initiation or rudiment in the Port-veines, but laboured and perfected by the power and efficacy of the *Parenchyma* or ſubſtance of the Liuer.

4. Reaſon.

How Cliſters do nouriſh.

5. Reaſon.

Notwithſtanding theſe things are ſo, ſome learned men among the new Writers, as *Thomas Veiga* and *Laurentius Iobertus* doe thinke, and mightily contend by manie arguments, that the Stomacke ſhould be nouriſhed by the thinner part of the Chylus, to which we will make ſome ſatisfaction.

Their reaſons who auouche the ſtomacke to be nouriſht with Chylus.

In the firſt place they oppoſe the authority of *Galen*, who in the third Booke of the naturall faculties, and in the fourth of the Vſe of parts in plaine words teacheth, that the ſtomacke hath his refection and nouriſhment by the Chylus. For anſwere to *Galen*, out of *Galen* we ſay, that there is a double nouriſhment; the one perfect, which is *Aſsimulation*, the laſt vpſhot and accompliſhment of natures endeauours in this kinde; the other imperfect, as it were the *Ape* or imitator of the former, which is a kinde of delight the part conceyueth from a quality that is of kinne vnto it; and this kinde of refection *Galen* calleth *Laſciua*, as if the entertainment were rather for dallience then procreation. And in this latter kinde the ſtomacke according to *Galen* is refreſhed by the Chylus, not in the former.

Firſt.

Anſwere

Galen expounded.

Secondly, they obiect that no branches of the Hollowe veine are deriued vnto the ſtomacke and the guts, but onely certaine ſmall rills from the Gate-veine, who haue but one vſe, which is, to tranſport the Chylus vnto the Liuer, and therefore (ſay they) the organs or inſtruments of nutrition are not nouriſhed with blood perfected in the Liuer (for there is no commerce by veſſels betweene them) but onely with Chylus. This Argument I take to be very ydle and friuolous: for if onely the riuerets or channels of the Hollow-vein did containe Alimentary blood, and the branches of the Gate-veine were onely ordayned to tranſport the Chylus, then ſhould the Spleene, the Meſentery, and the Kell bee likewiſe nouriſhed with Chylus, becauſe they haue no allowance of Veſſels from the hollow vein. In like manner the great guts ſhould aſsimulate Chylus into their nouriſhment, in which it is certaine there is nothing conteyned but the excrements, the iuice being before drawn from them.

Second.

Anſwered.

Their third Argument is taken from Diſſection, becauſe (ſay they) the Veines do only open at the Stomacke, and are not diſſeminated through his coates, and therefore they ſuck iuice from it, rather then nouriſh it with their owne allowance. But (alas the while) what new Anatomy is this? Is there not a double Gaſtrick or Stomacke-veyne ſtretched through all the Coates of the ſame? Beleeue me, the inſertion of theſe and other veines is altogether alike.

Third

Anſwere.

The fourth Argument is that of the Learned *Veiga*. The Organs (ſaith hee) of the firſt concoction are more ignoble, and are framed of farre impurer iuyce then the Fleſh; and therefore it is fit they ſhould be nouriſhed alſo with impurer iuyce, before it is concocted in the Liuer. But this reaſon drawes many abſurdities with it; for the bones are more ignoble then the ſtomacke or the guts, and colder by farre, and yet are nouriſhed by blood conuey-

Fourth.

Anſwere.

conueyed vnto them from the Liuer by the Hollow-Veine, yea, and alm oſt all the Membranes colde and baſe though they be, do draw that blood and no other, which is perfectly concocted in the Liuers *parenchyma* or ſubſtance.

The Fifte reaſon followeth, which they put great confidence in, and it is ſuch. If the Stomacke bee not nouriſhed with Chylus, how then commeth it to paſſe, that preſently vppon the taking of Meate both hunger and thirſt is appeaſed. Wee Anſwere, that there is a Double hunger, one Naturall, and another Animall: the Naturall is without ſenſe, and placed in the particular partes of the bodye. The Animall is with moſt exquiſite ſenſe, and proper onely vnto the Stomacke, yea eſpeciallie to the mouth thereof: the firſt is appeaſed onely by Aſsimulation; the latter, becauſe it is a ſenſe or apprehenſion of Divultion, when the Divultion ceaſeth, then it is alſo appeaſed.

Fifte. Anſwere. A double hunger.

Vpon the eating of meate, the Animall hunger of the Stomacke preſently falleth, becauſe the Stomacke being filled, his divultion and compreſsion ceaſeth: but the Naturall hunger is indeede appeaſed ſome-what when the inwarde coates are moyſtened as it were with a pleaſant Dewe, yet not altogether before perfect Aſsimulation, which is not accompliſhed without ſome diſtance or interpoſition of time. Thus farre theyr Arguments.

Now becauſe *Galen* ſaith, that *whatſoeuer nouriſheth muſt paſſe through three concoctions*. *Veiga* to ſaue his owne Stake, would interprete *Galen* as if hee meant this onelie of the nouriſhment of fleſhie parts, when as in a thouſand places he witneſſeth that blood alone is the fit and conuenient Aliment of all the parts.

Galen amiſſe interpreted by *Veiga*.

Againe, to eſtabliſh his falſe Opinion, hee coyneth verie cunninglie, a three-folde Concoction in the nouriſhment of the Stomacke. The firſt (ſayth hee) is Chilificatiō, which is made in the bottome: the ſecond, is Sanguification and perfourmed in his Veynes: the third, is Aſsimulation, which is accompliſhed in his coates. So that his pleaſure forſooth is, that the Chylus is ſucked by the Veynes, in them they are turned into Blood, and from them againe are they drawne by the Stomacke for his nouriſhment.

A quaint conceite of *Veiga*.

But in this Triple faigned Concoction, there is a three-folde errour. For firſt, it is moſt certaine that the bloode by no meanes becommeth redde but by contaction or touching the *Parenchyma* or Fleſh of the Liuer. Againe, I ſee no reaſon why that the Chylus ſhoulde bee rather drawne by the Veynes then by the Coates of the Stomacke, if there bee ſo great ſimilitude of ſubſtance betwixt the Chylus and his Membranes.

Wherein is a threefold errour.

Finally, if the Chylus were to bee drawne by the Veynes, and there get ſome rudiment of blood, it followeth neceſſarily that the Stomacke is not immediately nouriſhed by Chylus but by blood. And ſo much concerning the Appetite, Scituation, and Conſent of the mouth of the Stomacke, as alſo of the Chylification and nouriſhment of the Stomacke it ſelfe. Now proceede we to the Liuer.

QVEST. XII. *What is the Nature of a ſpirit, and whether the Liuer do breede or beget a Naturall ſpirit.*

BEcauſe in the Schooles of Phyſitians the Controuerſie concerning the naturall ſpirit is ſufficiently bandyed, I will not ſpend much time in a thing ſo notorious: onely for their ſatisfaction to whom theſe ſubtilties are moſt ſtrange and leſſe obuious, I will giue a taſte or ſhort aſſay concerning the nature of ſpirits.

Galen in his ſixt Booke of the *Vſe of Parts*, defineth a ſpirite to bee *A certaine exhalation of benigne or wel-diſpoſed blood*: The Stoickes call it, *The tye or band of the ſoule and the bodie*; for the diſtance is not ſo great betweene the higheſt Heauen and the loweſt Earth, as is the difference betwixt the Soule and the Bodye. It vvas therefore verie neceſſarie that a ſpirite ſhould bee created, by vvhoſe intermediate Nature, as it vvere by a ſtrong though not indiſſoluble bonde the Diuine ſoule might bee tyed to the bodie of Earth. Wherfore there are ſome that ſay it is an Aetheriall body, the ſeat and band of heate and faculty, and the prime inſtrument whereby all the functions of the ſoule are performed. But to ſay as the truth is, it is called Aetheriall onely Analogically,

Galen. What a ſpirit is.

How the immortall ſoule, and the mortal bodie are ioyned.

A definition of a ſpirit.

becauſe of his tenuity and diuine manner of working, for by his nature and in his originall he is meerely Elementary. Our definition of a ſpirit ſhall be this, *A ſubtle and thinne body alwayes mooueable, engendred of blood and vapour, and the vehicle or carriage of the Faculties of the ſoule.*

Hippocrates.

That it is a body *Hippocrates* witneſſeth, when hee reckons it in the number of thoſe things whereof the body is compounded; for he diuideth the body into *Continentia, contenta & impetũ facientia*, that is, into parts conteining, conteined, and ſuch as moue with a kinde of impetous violence. Another argument that it is corporeall, is, becauſe it ſtands in neede of a channell or paſſage wherein it may be tranſported, becauſe it diſtendeth the parts in which it is entertained and occupieth a place; for when the creature is dead, both the ball of the eye is corrugated or wrinkled, and the Membranes thereof doe alſo fall being no more illuſtrated by the beames of the ſpirits. It is therefore a body, but the fineſt and ſubtilleſt ſubſtance that is in this Little world. For as the winde it paſſeth & repaſſeth at his pleaſure, vnſeene, but not vnfelt; for the force and incurſion thereof is not without a kinde of violence; ſo the ſeede although it be thicke and viſcid, yet paſſeth thorough veſſels which haue no manifeſt cauities; the reaſon is, becauſe it is full & as it were bouen with ſpirits. *Galen* in his third Booke of *Naturall Faculties*, ſaith, *That blood is thin, vapour thinner, and Spirits thinneſt of all.*

That they are corporeall.

Like the wind

An inſtance.

Galen.

That the ſpirits are in perpetual motion

I ſaide moreouer, that it was alwayes in motion, for the ſpirits are continually moued, not by another onely as the humors (which whither they be drawne or driuen are alwaies mooued by a power without themſelues;) but alſo by themſelues, that is, by an inbred principle of their owne. So that there is a double original of the ſpirits motion, on homebred another but a ſtranger; by the homebred principle they are mooued as the flame vpward and downward, as *Galen* teacheth. Vpward, becauſe light; for they are fiery and airy: and downe-ward towarde their nouriſhment. If either of theſe motions bee hindred, the ſpirit is corrupted, and that by conſumption or extinction; by conſumption for want of nouriſhment when it cannot mooue downward; by extinction from his contraries, when it is choaked by cold and moyſture becauſe it cannot mooue vpwards. Againe they are moued by an externall principle, when they are Drawn hither or Driuen thither. They are driuen, the Naturall from the Liuer, the Vitall from the heart in his *Syſtole*, the Animall from the Braine when it is compreſſed. They are drawne, the naturall by the veines, the vitall by the particular parts together with the Arteriall blood; the Animall verie rarely, vnleſſe a part be affected either with paine or pleaſure. For in ſuch a caſe neyther dooth the vehemency of the obiect ſuffer the faculty to reſt, nor the heate ceaſe to draw the ſpirits vnto it. The ſpirits therefore haue a body mooueable.

A double principle of theyr motion.

How the Spirits are corrupted.

By conſumption.

By extinction

How the Spirits are driuē.

How drawne.

The Animall ſpirites howe drawne to a part.

Whereof Spirits are ingendred.

It followeth in the definition, that they are engendred of blood and a thin vapour; ſo that they haue a double matter, an exhalation of the bloode and aire; and therefore it is, that all our ſpirits are cheriſhed, preſerued and nouriſhed by aire and blood.

The Vſe of Spirits.

Binding of the veſſels intercepteth not the Facultie it ſelfe.

The laſt part of the definition deſigneth the vſe of the ſpirits, as being the laſt and finall cauſe for which they were ordained. For the ſpirits are the vehicles or carriages, not of the ſoule, but of the faculties thereof; for if the Veſſels Veines, Arteries, or Nerues be tyed, the life, motion and ſenſe of the parts to which theſe veſſels paſſe do inſtantly abate & are in ſhort time vtterly extinguiſhed vpon the interception of the ſpirits, not of the faculties themſelues which are incorporeall, becauſe the band or tye dooth neither interrupt the continuity of the veſſell with his originall, neither yet his naturall diſpoſition. And this is the nature of ſpirits in generall.

Spirits double *Argenterius* his opinion, that there is but one ſort of ſpirits.

Opinion of the Ancients, that there are three ſorts of Spirits

That there is an Animall ſpirit.

Reaſons.

Now ſome ſpirits are ingenit or in-bred, which are ſo many in number as there are ſeuerall kinds and ſortes of parts; ſome influent, which flowe as it were from diuers Fountaines, and ſerue to rowze and raiſe vp the ſleepy and ſluggiſh operations of the former. Concerning the number of the influent ſpirits, Phyſitians are at great difference among themſelues. *Argenterius* thinketh that there is but one ſort of ſpirits, becauſe there is but one ſoule and that hauing but one organ, one bloode and one ayre which is breathed in. But the Ancients farre more acutely haue recorded three manner of ſpirites, becauſe there are three faculties of the ſoule, the Naturall, the Vitall, and the Animall; three principles, the Braine, the Heart, and the Liuer; and three kinde of Veſſels, Veines, Arteries, and Sinnewes.

That there is an Animall ſpirit, beſide that *Galen* inculcateth it in ſundry places, many reaſons do euict it. For to what purpoſe elſe was the braine hollowed or bowed into ſo ma-

nie

ny arches? To what purpose are those intricate mazes and laberynthes of small Arteries which in the Braine we call *Rete mirabile*, the wonderfull Nette? And why are the sinewes propagated into so many braunches? But of this we shall haue occasion to speake more hereafter, as also of the vitall which no man yet euer opposed, and of which the Poet maketh mention, calling it a *diuinitie*. *Ouid.*

Est Deus in nobis, agitante calescimus illo.
In vs there is spirit seated,
And by his motion we are heated.

That there is no natural spirit.

Onely concerning the naturall spirit there hath been some difference, many labouring to blot his name out of the rowle; whose arguments we will here scite before the tribunall of Reason to see how they acquite themselues. First they say that the naturall faculty needeth no vehicle or weftage, because it is inbred in euery part, for which they auouch *Galen.* 1. *de loc. affect.* 12 *meth.* & *in arte parua.* Againe, there is no matter whereof this naturall spirit should bee made, because there bee 1. Reason. no vessels whereby ayre may be conuayed vnto the Liuer; neither is there any place for his generation, there be no such cauities in the Liuer as are in the Heart and the braine. 2. Reason. Ad hereto that there be no currents or channels to be found whereby it should be led through the body; for the coates of the veines are too thinne to hold or contain an ætherial spirit. 3. Reason. And truely *Herophilus* well conceiteth that therefore the Artery is manifolde (sixe fold sayth he) thicker then the veine, because it was made to conteine the spirits, which by reason of their tenuity, if they had not beene inclosed within stronger wals, would easily haue vanished away. 4. Reason. *Herophilus.*

Moreouer, seeing the spirits as *Hippocrates* sayth, haue in them a kinde of nimble violence and impetious motion, if they were contayned within the veines, they would make the veines to beate as do the arteries. Finally, if it be granted that the spirits doe passe and repasse through the veines, yet with what nourishment shall they bee preserued? For heate sayth the great *Dictator Hippocrates* is nourished by moderate cold; nowe there is no ayre led vnto the veines to serue that turne. 5. Reason. *Hippocrates.* 6. Reason. *Hippocrates.*

Answere to the former arguments.

These and such like are the arguments whereby they casheere this naturall spirit, which if they be weighed in equall balances will be found too light to sway an established iudgement. For first, *Galen* doth not absolutely deny that there is a Naturall spirit, only he casteth in a doubt as it were by the by, as also he doeth concerning the vitall spirite, in the fift chapter of the 12. booke of his *Method*, when yet notwithstanding it is beyond all controuersie that it is conteined in the arteries. But more plainly in the sixt of the *vse of Parts*, he writeth that there is a spirit conteined in the veines; yet are there but few of them, and those darke as he sayeth and cloudy. We confesse that there is a naturall faculty bred and seated in euery part, but because the heate and naturall spirit of the partes wherein this inbredde faculty doth consist is but vncertaine like a fugitiue, and dull or stupid; it standeth in neede of another influent yet like vnto it selfe, whereby it might bee stirred vp, established, and from a potentiall vertue brought into an operatiue act.

To the first. *Galen.*

The naturall spirit but cloudy.

The Arabians imagine that the blood is transported and guided through the whole body vnder the conduct of the spirit; for although euery part like a Load-stone doe draw vnto it selfe such iuyce as is familiar vnto it, yet if the distance of place be too great, neither can the Load-stone draw yron, nor Amber chaffe, nor the part his nourishment. To their second argument that there wanteth nourishment both for the generation and preseruation of this spirit because no ayre is conuayed vnto the Liuer; we answere with *Hippocrates*, that all bodies are *Transpirable* and *Transfluxible*, that is, so open to the ayre as that it may easily passe and repasse through them, though not so aboundantly as it doth by the windepipe, of which aboundance there is no neede, because this thicke and cloudy spirit needeth but a litle ayre for his refection, which is supplyed by transpiration. This Transpiration is made in the hollow parts of the Liuer by the Arteries. In the round or gibbous although there be no arteries, yet the midriffe with his continual motion as it were with a fanne, ventilateth or fanneth, not the Liuer onely, but all the entralles.

The Arabians conceit.

To the second *Hippocrates.*

Thirdly, whereas they say there is no cauity, no Cisterne, no place for generation of such a spirit in the Liuer; it is truely a very bold concluſion. But let vs sticke to them with as great confidence hauing *Galen* on our sides equiualent to a whole army of such inexperienced *Tyrones*. It was not necessary sayth he that there should be any cauity or cell in the Liuer such as are in the heart, because those bowelles onely which were either to receiue from others, are to affoorde and impart together-ward and at once a plentifull and aboun-

To the third.

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dant sourse of matter stood in neede of an ample cauity wherein it should be either treasured & stored when it is receiued, or wrought and framed when it is to bee conuayed. The vitall spirit as it is very fine and thinne and therefore quickly exhausted; so it behoued that it should as sodainely bee regenerated that there might neither want plenty for necessity, nor aboundance for sodain expence: it was therefore necessary that it should haue a large cauitie or Cauldron wherein it should be boyled and prepared for vse; as wee see Nature prouided large and ample vessels for the nourishment of the Lungs, because of their continuall motion, which requireth a supply answerable to the expence: but the naturall spirit as it cannot so sodainely spend it selfe, so there was no neede of any aboundant affluence thereof, and therefore the beds or webs of the veines were sufficient for his generation.

Why the vessels of the Lungs are large.

Fourthly, whereas they say that the thinne coates of the veines are too weake to guide and safe-conduct the naturall spirit; we answere in a word, that a thicke & grosse substance or dull prisoner is easily held in durance.

To the fourth

To the fift argument we answere, that the veines are therefore not moued, because the faculty of pulsation is not deriued vnto them from the heart; for we do not thinke that the Arteries are moued by the heate and spirits which they containe, but onely by a vitall faculty streaming through them by irradiation from the heart, as we shal prooue hereafter.

To the fift.

Finally, they aske how we think these spirits should be nourished? We answere, that it is transpiration which preserueth, refresheth, and maintaineth them, for euery veine hath his artery accompanying him continually, beside the manifold imbracements and inoculations, whereby they are as it were wedded one vnto another. Wee conclude therefore that there is a naturall spirit, the vehicle or guide of the Naturall faculty and of the thicker sort of the blood which is from the Liuer diffused into the whole body.

To the last.

The Conclusion.

QVEST. XIII. *Whether the Bladder doe draw the Choler vnto it for his Nourishment.*

THat there is a small Bladder tied to the hollow part of the Liuer, repleniſhed with a yellow bitter iuyce which we call *Choler* or *Gall*; there is no man ignorant who hath touched *Anatomy* as they say, but with his vpper lip. But whether this iuyce doe passe vnto the Bladder of it owne accord, or be drawne by the bladder, or abligated and sent by the Liuer, it is not altogether so manifest. That a meere Elementary forme should lead it by a kind of instinct or natural choice (for some choyces may be naturall) or election vnto that place, I thinke fewe men of reason will auouch. More likely it is that it is either drawne or driuen; *Galen* is for both, so is reason also; although *Fallopius* that subtle and occulate *Anatomist*, contendeth that it is onely driuen from the Liuer and not drawne by the bladder, to whome and his arguments we will set our feet in the next exercise.

The seate of the bladder of gall.

Galen.

Falopius.

That the choler is driuen from the Liuer, the very natue of the iuyce doeth sufficiently proue; it is an excrement, in his whole nature and quality hurtful and noxious, to the Liuer especially; and therefore it ought to be auoyded and that sooner and with more expedition, then the other two excrements, because his sharpe prouocations are more offensiue, and for that reason the receptacle of choler is tyed or fastned close vppon the cauity of the Liuer, but the spleene and the Kidneyes which receiue the other two, are set further off.

That the choler is driuen from the liuer

Why the bladder of gall is fastned to the Liuer.

Againe that this choler is drawne by the bladder of Gall, *Galen* teacheth in his fourth & fift bookes of the *vse of Parts*; and beside the fashion and conformation of the bladder it selfe and his passages doe aboundantly perswade vs thereunto; for because there be diuers Choler-conduits bending rather down to the guts thē to the bladder whose scite is higher; vnlesse the bladder had a peculiar & in-bred traction, vndoubtedly the choler would rather fall downe into the guts then arise vnto the bladder. The bladder therefore draweth this bitter iuyce, and that sincere without admixtion of any more benigne or pleasant humor.

That it is drawn by the bladder of gal *Galen.*

But whether this Traction of the Choler by the vesicle or Bladder bee for nourishment, or from a certaine consanguinity betwixt their qualities, or rather by a hidden and vnknowne propriety, it hath beene a question of old, and yet is not determined vpon record. *Laurentius Iobertus* set forth a paradox concerning this matter, wherein hee determineth that this bladder is nourished by Gall, as the spleene by melancholy, and the Kidneyes by *serous* or whaey blood, which opinion may bee established by these reasons. First, it is an axiome in Philosophy and Physicke, which *Galen* often inculcateth and vrgeth in his

Iobert. his opinion.

His reasons.

Galen.

bookes

bookes of naturall faculties, *That nothing draweth for the drawing it selfe, but for the enioying of that which is drawne*, that is to say, all traction hath some particular end for which it was instituted.

Now the Bladder draweth the choler: to what end? No doubt but for his nourishment; and this the colour of the bladder perswadeth, which is altogether yellow by reason of the choler asimulated vnto it. Secondly, the Veines that are dispersed and disseminated through the coates of the Vesicle are so small and hairy, that a mans eie can scarse finde them out, and therefore by them the Bladder, especially the inner part cannot bee nourished. Thirdly, *Galen* witnesseth that the Lungs are nourished by choler, why then may not the bladder a more ignoble part be nourished with more impure choler? These and such like are their arguments, who imagine that the traction of the choler is for the nourishment of the bladder. *Galen.*

On the contrary, we being guided by authority, and established by *Galens* weighty arguments, do not thinke that the bladder is nourished by Gall but by blood, conducted or led vnto it by the Veines; and that this traction whereof we haue spoken, hath some other end for which it is vndertaken & not for norishment. *Galen* in his 5. book of the vse of Parts and the 7. chapter writeth, that both the Bladders because they draw a sincere excrement altogether vnprofitable for nourishment, do stand in neede of bloody vessels or vessels full of blood by which they may be nourished. And againe, in the 12. chapter of the 5. book, he askes the Question why the stomacke and the guts haue double coates, and both the bladders but one, and that proper? He answereth himselfe thus. Because in the Bladders there was to be no concoction made of those things conteined in them; If no concoction of the substance, then no nourishment by the same. To these authorities reason also lendeth her assistance on this manner. All nourishment is by asimulation; but choler cannot be asimulated because it is an excrement; not offensiue onely by reason of his quantity, but also in his quality distastfull and vnsauoury. The conclusion we leaue for them to gather who hold the contrary. That the bladder is not norished by the gall. Authorities out of *Galen*. An argument out of *Galen*. Reasons.

A second reason may be, because Nature neuer attempteth any thing in vaine, why the were the two Cystick twinnes or veines which leade vnto this bladder ordained, if it were not for his nourishment? I confesse there are very small (though our grauer hath cut them large) but yet great enough for the nourishment of so small and vnbloody a part; and so much for the establishing of the truth.

Let vs now another while make answere to the arguments of our aduersaries aboue alledged. The bladder of Choler say they is yellowish, and that commeth by the asimulation of Choler. The Conclusion hangeth not well vpon the proposition. For the Colon also in that place where it toucheth the bladder of Gall groweth yellowish by the transudation or sweating through of the yellow iuice abounding therein; yet who will say for all that, that the colon is norished by the Choler? And whereas they compare the nourishment of the Lungs and the bladder of gall, they forget that choler is one thing, and cholericke blood another. The Lungs indeede are nourished with cholericke blood, that is verie thin and laboured to a height of heate in the left ventricle of the heart, but with excrementitious choler no part is nourished. The first opinion confuted. To the first argument. To the third.

If they obiect that the Spleene and the Kidneyes are nourished, the one with excrementitious and fœculent blood, the other with *Serous* and whaey; we answer, that we will make any man iudge whether there be the like reason of all these partes, the Kidnies, the Spleene, and the bladder. For albeit the Spleen doth draw vnto it fœculent blood, and the Kidnies a *serous* excrement, yet are not these pure and vnmixed; for their vessels, to wit, the Splenick branch and the Emulgent veines are very large. Now we may remember that *Galen* saith, that those parts which draw any iuyce through ample and large orificies cannot draw it pure and sincere, and therefore the Spleene and the Kidneyes do draw their excrements mingled with much benigne and alimentary blood, with which blood they are nourished, but the vnsauoury excrement they separate and auoid. But the bladder draweth vnto it selfe pure and sincere choler, not mixed or adulterated with any other humor, as well because the narrownesse of the passage will not admit any thing thicker, as also for that the attraction is stirred vp by a familiarity betwixt the bladder and the humour. It remaineth therefore cleared as we hope, that the bladder drawes not the choler for his nourishment. Obiection. Answer *Galen.* Howe the Spleene and Kidneyes are nourished.

If it be demanded why then it draweth? We answere, that *Galen* thought it was by reason

Similitude. ſon of a familiarity and ſimilitude betweene them to vs vnknowne, it may bee alſo incomprehenſible. For as the Load-ſtone draweth yron, and Amber chaffe; ſo the bladder draweth choler, with whoſe preſence it is delighted and tickled as it were with a ſence of pleaſure. For ſo he ſayth in the 10. Chapter of the 5. Book of the *vſe of Parts*; *Choler is drawn by the Bladder, by reaſon of a communion of qualities.* For as long as the Creature is a liue, though he liue very long, yet alwayes there is choler contained in the bladder of Gall, yea and after death, if wee will keepe the Gall long, wee may preſerue it beſt in his own bladder; neither of them ſuffering violence by other in any reaſonable tract of time, for thoſe things that are familiar and as it were a kin, will not offer violence one to another.

Galen.

Why gal keepeth beſt in his own bladder.

Obiection. If any queaſie ſtomacke ſhall aske the queſtion how the bladder can be delighted with ſuch an excrement whoſe rage and acrimony is ſo fierce that if it ſtay but a little in the guts it vlcerateth them, & if it be poured into the habit of the body, by irretating the pannicle or fleſhy membrane it ſtirreth vp a rigour or generall ſhiuering? How the bladder which is membranous and therefore of exquiſite ſence, ſhould not feele that acrimony or be offended with ſo impure a humor? We anſwere firſt with *Lucretius*, *That Nature couereth many things vnder a ſacred veyle*, and that in this great vniuerſe, the ſympathies and antipathies of things are ſecret and wonderfull. Againe, the Bladder is delighted with the preſence of the choler, and therefore is not hurt by his acrimonie. Happely alſo becauſe it is vſed to it, it is not afflicted by it; ſo thoſe men that are accuſtomed to poyſon, doe not feele the poyſonous power thereof, and a drop of liquor ſtrangleth well-nigh the Arterie, whereas full cups delight the ſtomacke. Againe, the ſtomacke is pained with a little ayre, and the guts torne aſunder with cruell torments, but the Lungs becauſe they are accuſtomed vnto it, do ſwallow the aire in great aboundance and are refreſhed thereby.

Anſwere. *Lucretius.*

Cuſtome taketh away ſence.

Similitudes.

Thoſe men that will not admit of this familiarity or acquaintance betweene the choler and the bladder, doe referre the cauſe of this Traction to the neceſſity and prouidence of the vniuerſall Nature; to wit, that the blood may be purged, leaſt being defiled with ſuch an excrement, it ſhould become vnprofitable for nouriſhment.

QVEST. XIIII. *Of the paſſages by which the Choler is purged, againſt Falopius.*

The commendation of *Falopius.* *Gabriel Falopius*, the moſt acute and ſubtle Anatomiſt of our age, hath deſerued exceeding wel in opening vnto vs many things which in the former ages were not knowne. He firſt of all men did acurately deſcribe the Hiſtory of a mans Eie, and obſerued that griſtly body which they call *Troclea.* Hee firſt found out the yarde of the wombe called *Clitoris*, beſide the manifold nicities foulded as it were in a thouſand difficulties, which hee hath manifeſted and brought to light in the Hiſtoryes of the Muſcles, the Veines, and the Sinewes; yet notwithſtanding this great learned man in his Aſſignation of the vſe of the Bladder of Gall, whileſt hee deſcribeth the paſſages wherby the choler is led, in falling from the authority of the Ancients, falleth into an error whereof he cannot be excuſed.

Dargerous to vary from the ancients.

The two paſſages of choler. *Falopius* his opinion. The ancient opinion and indeede the very trueth is, that there are two paſſages of the Gall, one diſtributed into the Liuer with aboundante ſhootes, the other paſſeth from the veſicle vnto the Guts. By the firſt the Bladder draweth the Gall vnto it ſelfe; by the ſecond it diſchargeth it again into the *Duodenum*. *Falopius* on the contrary, conceiteth that thoſe paſſages of choler which are diſſeminated through the Liuer runne directly not vnto the Bladder but to the *Duodenum*, and doe continually thruſt out the choler thereinto. And becauſe it hapneth full oft, that the guttes are either diſtended with winde, or in the time of diſtribution are fulfilled with Chylus; ſo that the paſſage or out-let ordained for the auoyding of choler is intercluded or ſhut vp; leaſt ſayth he, the choler ſhould flow back and returne vpon the Liuer to defile the blood, Nature hath framed the Bladder as it were a diuerticle or ciſterne out of the way, wherein the choler might bee gathered and reſerued togeather, whileſt the out-let in the *duodenum* ſhould be opened.

Wherefore there be two things which *Falopius* would haue; the firſt that the Choler paſſeth directly from the Liuer to the *duodenum*: the ſecond that the Bladder draweth not choler, but that it returneth thither from the guttes when they are diſtended. Which two aſſertions, by the fauour of this learned man, we cannot ſubſcribe vnto; becauſe we thinke that we are able to demonſtrate the contrary both by reaſon and ſence, the two moſt certayne

Arguments againſt *Falopius*

taine Iudges and determiners of all controuerſies. Firſt therefore wee ſay and lay as a ground, that in the whole frame and ſtructure of the body there is nothing done or generated as accedentary, but onely vpon certaine ground and neceſſary vſe. Now the vſe aſſigned to the bladder by *Falopius* is but accedentarie and caſuall; for it is not perpetuall that the guts are diſtended with winde and their paſſages intercluded; but this happeneth rarely and but to ſome bodies and thoſe of good conſtitution. Hence it will follow that the bladder muſt be vnprofitable, and idly framed by Nature, which true and ſolid Philoſophy will neuer grant. For Nature at no time endeuoureth againſt the cauſes of diſeaſes, but againſt ſuch as doe dayly and neceſſarily happen. For it was the originall determination of the great Arificer of this noble *Fabricke*, to create a ſound and not a ſickly habitation for the ſoule: and therefore he generated the parts at the firſt hand for themſelues, and not afterwarde or at aduenture, albeit one and the ſame particle haue many and diuerſe by vſes.

Nature endeuoureth a ſound body not a ſickly.

The ſecond engine which we conceiue theſe paper walles cannot withſtand, ſhall bee this, that it is neceſſary that the *Bilious* excrement ſhoulde paſſe vnto the bladder before it went to the out-let in the *duodenum*. For if it ſhould flowe by degrees and perpetually vnto the guts, it would not moue them to excretion, becauſe a little choler and that falling by droppes, would haue beene too weake for this motion. But becauſe it is drawne by the bladder, therein gathered and at length aboundantly and at once povvred foorth into the waies of the excrements, it moueth their diſpoſition by certaine diſtances and with a kinde of ſuddainnes.

The cauſe of euacuations.

Thirdly, vnleſſe wee admit the Traction of the bladder, and a propriety whereby it is conteined & reteined to a certain time, what would it haue auayled it to be ſeparated from the blood? For if it alwayes deſcend directly from the Liuer to the gutte, then muſt it bee mingled againe with the Chylus and defile it; for the way is open, neither can the diſtribution of the Chylus as *Falopius* dreameth, interclude the paſſage of ſo thin and ſubtle a humor. Againe, if the choler ſhould returne vnto the bladder, onely when the paſſage into the *duodenum* is ſtopped, then ſhould not the bladder be alwayes found ful of choler, which is euermore to bee ſeene in ſound and healthy bodies. Ad hereto, that if the bladder were onely prouided for a diuerticle to ſet the choler as it were out of the way; what neede was there of ſo great a cauity? A little bodie would haue ſerued that turne, the firſt intention of nature being not to ſend it thither but vnto the gutte. Furthermore if the bladder had no power of Traction, why ſhould the choler rather returne vnto it then vnto the Liuer, when the paſſage to the veſicle is longer, more crooked & oblique? For if there be nothing but a ſimple refluxion, it is moſt reaſonable that ſhould be by the broader and the ſhorter way, which ſeeing it is not, we conclude that it is drawne.

Finally, if the Choler did onely regurgitate and flowe backe and were not drawne, it would not be reteined, but diſpatched away againe in the ſame moment as an vnwelcome gueſt, and ſo this refluxion ſhould be in veine. For if it be not familiar vnto the bladder, why ſhould it not prouoke it as it doth the guts and the ſtomacke.

Nature ſayth *Galen* vnburdneth not the Gall into the ſtomack becauſe it was offenſiue, for if with his bare touch hee moueth the guttes to excretion, ſurely it would haue ouerthrowne the concoction of the ſtomacke. *Galen* asketh the queſtion why the guttes haue two coates, and the bladders which conteine ſo ſharpe humors as the vrine and the choler but one a peece? hee anſwereth himſelfe, becauſe the choler is noyſome to the guttes, but pleaſant and familiar to the bladder, a little of it prouoketh the guts, and not the bladder, becauſe they draw it not, neither is it familiar vnto them as it is vnto the bladder.

Galen his obiection. *cap.* 4. *lib.* 5. *de vſu part.*

His owne anſwere.

I thinke that the onely reaſon which moued *Falopius* to father this conceite, was becauſe he ſaw that the paſſage from the Liuer to the bladder was crooked or oblique, but direct and ſtraight from the Liuer to the Gut; and that therefore it could not ariue ſo ſoone at the bladder by that crooked paſſage as at the gut by the ſtraight. Yet againe me thinks this argument or reaſon ſhould bee too light to tranſport ſo wiſe a man; for the motion of the expulſiue faculty is one, and that of the tractiue another, and the motion of the Elementary forme different from them both. That motion which followeth the Elementary forme is ſtraight and direct, and rather followeth the ſhorter, more ample and ſtraighter paſſages. In the motion of the Tractiue faculty which is from the ſoule, neither doth the obliquity of the paſſages withſtand it, nor the grauity or waight of that which paſſeth; for phlegmaticke blood, although it be heauy aſcendeth vnto the braine, and in the time of famine

The motion which followeth the elementary form

The tractiue faculty.

mine the ſtomacke recalleth the thicker excrements. Seeing therefore that choler is drawn by the bladder, the crooked paſſage cannot hinder his ready obedience. Beſide, the way from the Liuer to the bladder could not be direct, becauſe it is placed in the hollowneſſe of the Liuer, ſo that the paſſage muſt firſt deſcend, and then aſcend.

Obiection.

It will be obiected, if the bladder do draw the choler becauſe it is familiar vnto it, why doth it then diſcharge it ſelfe of it againe? For by the ſame propriety by which it draweth, it ſnould alſo retaine and delight it ſelfe therewith. I anſwere, that the choler is not excluded vnleſſe it be offenſiue either in quantity or quality; and ſure it is, that by long continuance in the bladder, it becommeth more ſharpe.

Solution.

Creatures hauing no bladder of Gall.

Now whereas it is obiected by ſome, that the bladder draweth not the choler, becauſe many creatures haue it not at al, they heereby conclude nothing. For where the bladder is wanting there hee were wood that would ſay the bladder drew it; but wee acknowledge this vſe of drawing the choler in thoſe creatures, at the cauity of whoſe Liuer a bladder is ſet. That this bladder is wanting in ſome creatures, *Ariſtotle* writeth 2. *de hiſt. Anim. cap.* 15. The bladder of gall (ſaith he) in ſome is tyed to the Liuer, in ſome not: in the Hart and the Hinde it is obſerued to be wanting, as alſo in the Horſe, the Mule, the Aſſe, & the ſea-Calfe; the Harts called *Achaini*, are thought to haue it in their taile; the Elephant and the Dolphin haue no gall in their Liuers. In *Euboea Chalcide* an Iſland in the midland Sea neere *Greece*, the Cattle haue none; in *Naxus* they haue it double and very large. Finally, if as *Falopius* thinketh, it be ſo likely that the choler is at firſt hand led away from the Liuer to the gut becauſe that paſſage is the ſhorter, let him giue me leaue to retort vppon him his owne weapon. It ſhall therefore, ſay I, returne from the gut vnto the Liuer rather then to the Bladder, becauſe the paſſage is not ſo oblique, and ſo there will become no vſe at all of the bladder, if it be onely deſtinated for a Diuerticle.

Ariſtotle.

Cerui Achaini. Gall in the taile.

Falopius argument retorted

Arguments againſt *Falius.*

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But let vs at length paſſe from reaſon to experience, which we will exhibite as plainly as we haue often found the ſame in our Diſſections. I ſay therefore, that from the Liuer to the Bladder, there is an ōpen or through paſſage and very conſpicuous, but not from the Liuer to the gut. Again, from the Bladder to the *Duodenum*, there paſſeth another hollow pipe, but none from the *Duodenum* to the Liuer, and in each of theſe paſſages there are Values which hinder the refluence of the choler. That this is ſo, may eaſily be ſeene if you put a pipe or Bugle into the paſſages of the Liuer, and then blow it, for the bladder wil ſooner be puffed vp then the gut, becauſe the way is open from the Liuer to the bladder. Againe, if you put your Bugle into the bladder and blow it, then will the paſſage of the gut be diſtended, not that of the Liuer. So then, the choler paſſeth firſt from the Liuer to the Bladder, and after from the bladder to the *Duodenum*.

The Values of the paſſages of Choler.

Inſtance.

The concluſion.

To conclude therefore, the Bladder draweth the choler from the cauity of the Liuer, retaineth the ſame for a certaine time, and after in a ſeaſon onely knowne and appointed by Nature, diſchargeth it againe into the guts. And this was the opinion of the ancient ſages of our Art. *Hippocrates* in his fourth Booke of diſeaſes, *Galen* in diuers places, and in a word the whole Schoole of Phyſitians haue receiued it without oppoſition. Now, where there is ſo great a conſent of learned and wiſe men ioyned with the authority of all antiquity, I am not eaſily drawne to dance after the nouell muſicke of a wanton wit, which ſhall varie there from.

Hippocrates. *Galen.*

The duplicitie of the lower paſſage of choler.

But that there may be nothing wanting in the hiſtory of theſe paſſages, it is woorthy our obſeruation, that the latter way by which the bladder emptieth himſelfe, is ſometimes found double, that is, there be two branches thereof, of which one paſſeth vnto the bottome of the ſtomacke, and the other to the *Duodenum*. *Galen* made mention of both theſe in his ſecond Book of *Temperaments & in arte parua*: and *Veſalius* affirmes that hee ſaw it once. Sometime this channell of choler is but one, and is by nature framed amiſſe, being inſerted in ſome men vnto the bottome of the ſtomacke, in others below the *Duodenum*, the former ſort do continually vomit choler, the latter as continually auoyde it by ſeidge; the firſt are called πικρόχολοι ἄνω *Cholericke vpward*, the other πικρόχολοι κάτω *Cholerick downward*, *both cholericke* (ſaith *Galen* ἕξει, that is) *in their habite and conformation.*

Galen. *Veſalius*

Hip. de victus ratione in acut.

Two ſorts of cholerick mē. A cholerick Temper. A cholericke Habit.

To make theſe things more plaine, we muſt obſerue that according to *Hippocrates* and *Galen* there are two ſorts of cholericke men, ſome are ſo by nature, ſome by euent or accident. By nature cholericke, is either in Temperament, or in Habite. In Temperament thoſe are cholericke, whoſe Liuers are hot aboue meaſure; for a hot Liuer engendreth abundance of choler. In habite, thoſe are called cholericke whoſe bladder of gall is ſo formed

med, that the Canell or passage of the gall runnes either to the stomacke, or to the emptie gut, and yet both these thus habitually cholericke, may in their temperament be Flegmaticke. There is an elegant history in *Galen*, in his Commentary vpon the second section of the Booke, intituled *de victus ratione in morbis acutis*, concerning *Paul* the Rhetoritian, and *Eudemus* the Philosopher: the Rhetoritian was altogether Flegmatick, yet vexed with continuall vomitings, and for the most part costiue: the Philosopher had many cholerick euacuations downeward, but none by vomit. All these are called *Bilious* or cholericke by nature. There are also some cholericke by euent, that is by a temperament acquired, as by labour, watchings, anger, sharpe, salt and spiced meates.

A Storie out of *Galen*.

Bilious by euent.

But whether the bladder do draw and driue the choler by one and the same way, many haue made question. A certaine new writer, a great interpreter of *Hippocrates*, but not so well practised in Anatomy writeth, that there are two passages inserted into the bodye of the bladder, by one of which it draweth, by the other it driueth forth the gall. But these are meere imaginations, for the passage of the bladder is onely one, whereby it both draweth and auoydeth choler, though at seuerall times: yet from this common passage do spring two small twigges, the one diuersifyed into the Liuer, by which it draweth onely, the other inserted into the *Duodenum*, by which it onely expelleth. And this *Galen* vnderstood right well, as appeareth in the thirteenth Chapter of his third Booke of Naturall Faculties. *It is not hard* (saith he) *to conceiue how traction and expulsion should be made by the same passage at seuerall times, if we consider that the gullet doth not onely leade meate into the stomacke, but also in vomiting casteth it out by the same way.* And thus much of the Bladder of gall, now we proceede to the Spleene.

An idle conceite.

The truth.

Galen.

QVEST. XV. *Concerning the vse of the Spleene against the slanderous calumniations of Galens Aduersaries.*

THere be diuers opinions as well of the Ancient as Moderne writers about the vse of the Spleene, *Erasistratus* thought it not of any great moment. *Aristotle* in his third Booke *de partibus Animalium*, confesseth it to be necessary indeede, yet not absolutely, but by euent, although hee sayth it sometime draweth the excrement from the stomacke, and worketh it vnto his nourishment. Both these opinions haue beene hissed out of the Schooles of Physitians, as being neither established by reason, nor agreeing with the maiesty, wisedom, and policy of Nature, who vseth not to create any thing in the frame of our bodies, which is not necessary for the better gouernment and order of the common wealth of the same. *Alexander Aphrodiseus sect. 2. problem*, and *Aretæus lib 1. de causis & signis chronicorum*, and the author of the Book *de Respiratione* do conclude, that the spleene is the organ of sanguification, and they call it the bastard Liuer. In this say they is the veinall blood prepared and concocted, yet doth their beleefe rest vpon coniecture, because the frame and structure of both the bowels is alike; because in both of them there are large and ample vessels; because nature vseth to make the common ministers or seruiceable partes of the bodie, either double, or if but single then that one is placed in the middest, as the heart, the stomacke, the wombe, the bladder, the mouth, the tongue, and the nose; because the Liuer is in the right side and the Spleene in the left, they seeme to bee two organes ordained for one and the same action. But these bare coniectures are too weak to make a party that should hope to preuaile against a common receiued opinion. For how could nature haue set two so ample bowels which were to serue the whole bodie in the midst vnder the heart, and how again should she not haue bin idle if she had made more instruments then one for sanguificatiō, when one was sufficient? *Rondeletius* was of opinion that the Spleen is not the receptacle of the melancholy humor, because that humour remaining in his naturall integrity, is spent vpon the bones & other hard and dry parts of the body, and because there is left of that humor in vs, there is no part appointed to receiue the superfluities thereof, like as there is no place ordained to receiue the recrements of the blood, which for the most part do passe away by sweats and insensible transpiration. *Bauhin* runneth a middle course between these whose arguments we haue heard before in the history, & may receiue answer partly by himselfe, partly by the answere to others. *Vlmus* a Physitian of *Poytiers* in France, in an elegant and wittie Booke which hee set out of the Spleene, hath deuised a newe and vncouth vse thereof, that is, That in the Spleene the Vitall spirite is prepared: hee meaneth that the thinnest part of the Bloode, which is the matter of the Vitall spirite, passeth from the Spleene thorough

Erasistratus. *Aristotle.*

Alexander and *Aretæus.*

Their reasons

Confuted.

Rondeletius his opinion.

His Reasons.

Vlmus his opinion.

the Arteries into the lefte ventricle of the heart, where it is mingled with the aire, and perfected & ſo powred foorth through the arteries, as it were thorough chanels and watercourſes into the body. And this new paradoxe he eſtabliſheth with reaſons, which carry a ſhew of great ſtrength and euidence of truth.

His reaſons.

The matter (ſaith he) of the vitall ſpirit is double, Aire and Blood, and both theſe ſtand in neede of preparation and attenuation: the Aire is prepared in the Lunges, but the Blood not in the right ſide of the heart as *Galen* would haue it, becauſe there are no manifeſt paſſages from the right to the left ventricle: not in the Lunges as *Columbus* thought, and therefore in the Spleene.

Moreouer, we are perſwaded (ſaith he) heereunto both by the ſtructure of the Spleene it ſelfe, and by the Symptomes or accidents which follow thoſe that are ſplenetick. For the ſtructure, *Hippocrates* in his firſt Booke *de morbis mulerum* ſaith, that *the Spleene is rare and ſpongy, as it were another tongue.* Beſide, there are innumerable foulds of Arteries therein; now theſe foulds are no where ordained but for a new elaboration, and therefore in the Braine is the wonderfull or admirable web formed, in the teſticles mazy veſſels, in the Liuer millions of veines; wherefore it followeth that Nature hath ordained the ſpleene for the preparing and attenuating of vitall bloode. Add heereto, that all the Symptomes of ſpleniticke perſons, as a liuid or leaden colour, vnſauoury ſweate, aboundance of lice, puffings or ſwellings of the feete, palpitiations of the heart, are demonſtratiue ſignes of a languiſhing or decayed heate and impure ſpirits.

Hippocrates.

The probability of theſe arguments hath made many to ſtagger in their reſolution concerning this point, and yet notwithſtanding if they be called to the touchſtone, wee imagine they will proue no current Coine. For how may it be that the vitall ſpirit prepared in the webs of the Spleene, ſhould be conueyed by the great Artery vnto the left Ventricle of the heart, when at his orifice there are three Values or Membranes ſhut without and open within, which hinder the ingreſſe of any thing into the heart? And this *Hippocrates* in his Booke *De corde* plainly auoucheth, whoſe words becauſe they are ſweeter then Nectar and brighter then the midday Sun we will willingly tranſcribe. *At the mouths or ingate of the Arteries, there are three round Membranes diſpoſed, in their top like a halfe circle, and they that prie into theſe ſecrets of Nature, do much wonder howe theſe orifices and ends of the great Arteries do cloſe themſelues: for if the heart be taken out, and one of thoſe Membranes be lift vp and another couched downe, neyther water nor winde can paſſe into the heart: and theſe Membranes are more exactly diſpoſed in the mouthes of the left ventricle, and that for very good reaſon.* Thus farre *Hippocrates*. From whence I gather, if nothing can paſſe through the Artery into the heart, how ſhall the bloode attenuated in the Arteries of the Spleene paſſe thereinto, as *Vlmus* conceiteth? But I know what the anſwere will bee, that thoſe Membranes are not ordained altogether to hinder the paſſage too and fro; but that nothing ſhould paſſe or repaſſe together or at once after a tumultuous manner. But this is idly to decline the force of the argument, for the blood that is brought into the heart for the generation of vitall ſpirits, muſt both be aboundant, and at once aboundantly exhibited vnto it; which theſe *ſemicircular* Membranes will not admit. But concerning this queſtion, wee ſhall haue occaſion to diſpute heereafter when we entreate of the preparation of the vitall ſpirit.; for this time therefore thus much ſhall ſuffice.

Hippocrates.

Vlmus opiniõ confuted.

Hippocrates.

Obiection. Anſwer 4. vſes of the Arteries of the Spleene.

Notwithſtanding, whereas he obiecteth that the large and manifold Arteries which are in the Spleene were not ordained in vaine but for a further elaboration of blood, I anſwer that the vſe of the Arteries of the Spleen is fourefold. The firſt, that by their pulſation they might purge and attenuate the fœculent and droſsie blood; the ſecond to ſolicit or cal this blood out of the Veines into the ſubſtance of the Spleene; the third to ventilate or breath the naturall heate of the Spleene defiled and almoſt extinguiſhed by ſo impure a commixtion, leaſt it ſhould faint and decay; and finally, to impart vnto the Spleen the vitall faculty. And ſo wee ſee how theſe notable Arteries are not without eſpeciall Reaſons ordayned.

Anſwere to the argument of the Symptomes.

As for the Symptoms which follow Splenitick Patients, they happen from the impurity of the blood, not yet cleanſed from this fœculent excrement, and are rather effects of a fault in ſanguification then of the ſtore-houſe of the ſpirits. Moreouer, if the Spleen had beene ordained for the preparation of the vitall ſpirit, it ſhould haue been found in all perfect creatures, becauſe that ſpirit is of abſolute neceſsity for the maintenance of life. Yet *Laurentius* ſaith, that a few yeares before he wrote his Anatomy, hee cut vppe at *Paris* in *France*

Perfect Creatures may liue without their Spleenes.

A Hiſtory out of *Laurentius*.

France the body of a young man corpulent and full of fleſh, wherein he found no ſpleen at all: the ſplenicke braunch was there and that very large, ending into a ſmall glandulous or kernelly body, and the two *hæmorrohidal* veines which purged the fœculencie of the bloud. *Pliny* in the 11. Book of his *Naturall* hiſtory, writeth that the Spleen is a great hinderance to good foot-man-ſhippe or ſwift running, and therefore ſome doe vſe to ſeare it, yea and they ſay that a creature may liue though it bee taken out of the ſide. Againe thoſe creatures which haue leſſe of this droſſie ſlime haue no ſpleenes, and yet it is not to bee denyed but they ingender vitall ſpirites. Hereof *Ariſtotle* is a witneſſe, in the 15. Chapter of his ſecond booke *de hiſtoria Animalium*, where hee ſayeth that the Spleene is in all creatures which haue blood, but in many of thoſe which lay egges it is ſo ſmall that it cannot almoſt be perceiued, as appeareth in Pigeons, Kites, Hawkes, and Owles.

Pliny.

Ariſtotle. Creatures that lay egges haue ſmal ſpleenes.

Theſe thinges being ſo, let vs now lay downe our opinion concerning the vſe of the ſpleen. We will therefore with *Galen*, that the ſpleene is ordayned for the expurgation of fœculent blood; and therefore Nature hath placed it oppoſite to the Liuer, that the thicke and muddy part of the iuice being drunk vp and exhauſted, the blood might be made pure. This melancholy iuyce by a wonderfull prouidence and vnknowne familiarity the Spleene inuiteth vnto it ſelfe, yet not pure and vnmingled as the bladder draweth choler, but allayed with much benigne iuyce and laudable blood; becauſe as wee ſayed before, where the draught is made through large orificies, there the iuyce is neuer ſincere, but mixed with ſome other humour.

Concerning the vſe of the ſpleene, agree ing with the trueth.

This bloud thus drawne and brought by the *Splenicke braunch*, the aboundance of Atteries doe attenuate, mitigate, and concoct, making it like vnto the Spleene which is nouriſhed with the purer part thereof. This *Galen* witneſſeth where he ſayth, *That the Spleen draweth thicker blood then the Liuer, but is nouriſhed with thinner, and the impurer part ſometime belcheth backe into the bottome of the Stomacke, ſometime falleth into the Hemorrhoidall veines*: and this is the true and vniforme opinion of *Galen* and the moſt Phyſitians concerning the vſe of the Spleene, which it ſhall not bee amiſſe to proue alſo by ſome arguments. It is moſt certaine that in the Liuer there are ingendred with the blood three kinde of excrements, one thinne and more ayrie which ſwimmeth aloft and is called *Choler*; another thicker and more earthy anſwering to the lees of wine, the third waterie and whaey. The Choler becauſe his acrimony is more prouoking, is firſt of all ſent aſide; the melancholly iuyce as being more myrie and impure, needes the more forcible expurgation; for this expurgation, it was neceſſarie there ſhould be ſome receptacle and that not far diſtant from the place of concoction.

Galen.

Confirmed by reaſons. The firſt.

This receptacle is neither the ſtomacke nor the guts, nor the Kidneyes, nor the braunches of the hollew veine: it remaineth therefore that it muſt bee the Spleene, which receiueth a notable ſplenicke branch from the trunke of the gate veine and the lower partes of the Liuer. An argument hereof is the couler of the ſpleen, which is almoſt in all creatures blacke or browniſh, as alſo ſowre to taſte: now ſuch as the couler is of any part, ſuch is the humor that hath dominion therein.

From the cou lor and taſte.

Moreouer that the Spleene is ordained for the drawing and purging of the lees of the blood, theſe things doe ſufficiently witneſſe; becauſe it is moſt ſubiect to obſtructions and ſchirrous tumors, not by reaſon of his ſubſtance, for it is rare and fungous like a faſt ſponge or a ſmooth pumie-ſtone; not by reaſon of his veſſels which are very large: wherefore by reaſon of the humor contained therein, which if it were thin would neyther beget obſtructions nor ſuch ſcirhous hardneſſes. This *Galen* teacheth in the 13. booke of his Method. *The ſubſtance* ſayeth hee *of the Liuer is very liable to the ſcirrhus, as Naturally conteining ſome myrie and groſſe iuyce: the ſubſtance of the ſpleene is more rare and open then that of the Liuer, but yet is oftner afflicted with ſcirrhous tumors, becauſe of a kind of Aliment wherewith it is refreſhed.* And againe in his 5. Booke of the *Faculties of ſimple medicines*. *The Spleene hath ample paſſages.* From whence then proceed theſe frequent obſtructions but from the groſſe and fœculent blood? In reſpect of this thicke humor, *Galen* in his 5. Booke *de ſanitate tuenda* ſayth, *That the Spleene is helped by the exerciſe of the vpper and lower partes to attenuate it.* And in *Plutarch Orchomenes* the *Lacedemonian* was very ſpleeniticke, yet hee ſo exerciſed himſelfe in running, that at length he obtayned the prize in a race.

2. Argument.

Why the ſpleen is ſubiect to obſtructions & ſcirrhous Tumors. *Galen.*

Plutarch.

Furthermore, that the ſpleene is the receptacle of fœculent blood may thus be demonſtrated: If the ſpleene bee obſtructed, this muddy blood floweth preſently backe vnto the Liuer, and infecteth that which is pure and laudable with his couler, and hence the habite

3. Argument.

The cauſe of the black and yellow iaũdiſe

of the body becommeth melancholy, and the patient ouertaken with the blacke Iaundiſe, euen as when the paſſage of gall is obſtructed the choler returneth into the Liuer, whereupon the whole body becommeth yellow in a yellow Iaundiſe. For this cauſe I thinke it was that the Ancientes placed the ſeate of laughter in the Spleene, for it is a knowne diſticke.

Cor ſapit ac pulmo loquitur fel continet Iras,
Splen ridere facit, cogit amare iecur.
The ſeate of wiſedome is the Heart, the Lungs our Tongues doe moue:
The Gall our Rage, the Spleene our Mirth, the Liuer holds our Loue.

Plato.

And the Diuine *Plato* aluding hereto, writeth that the Spleene is placed next vnto the Liuer to keepe it alwayes pure and bright and ſhining like a mirrour, fitte to returne the Images of thoſe things that light vpon it.

Obiections.

But there are many things obiected againſt the trueth of this opinion, which it is very reaſonable we ſhould anſwere and diſſolue. If the Spleene had beene ordained for the drawing and purging of the melancholy iuyce, then Nature would haue prouided ſome paſſages to leade it from the Liuer; there ſhould haue beene alſo ſome cauity to receiue it, and ſome wayes by which it might be thruſt forth. So there are certaine paſſages of the gall diſperſed through the whole body of the Liuer, and hollow like Arteries which leade the choler from the Liuer: there is alſo a notable cauity in the bladder recieuing it, & wayes by which it is thruſt downe into the *duodenum*. In like manner, Nature for the vrine prouided the emulgent veſſelles to leade it from the hollow veine: the membranous cauities of the Kidneyes to receiue it, and the vreters and bladder to expell and auoyde it; but for the melancholy iuyce there are no proper and peculiar paſſages to leade it to the Spleene, no cauity or hollowneſſe in the Spleene to receiue and conteine it, nor any wayes whereby it might be auoyded; and therefore the Spleene is not ordained for the drawing and expurgation of this humor. That there is no pipe, paſſage, or veſſell appointed for the tranſportation of theſe lees of the blood may be proued thus. Nature is ſo prouident that as ſoon as ſanguification is perfected, ſhe prouideth that the noyſome and *heterogenie* parts ſhould bee purged and ſeparated from the laudable blood, that it might not bee adulterated with their contagion. But if the melancholy iuyce ſhould paſſe away by the ſplenicke braunch, this councell and law of Nature ſhould be vtterly ouerthrowne, becauſe it muſt needs paſſe through the trunke of the Gate-veine, and defile with his ſlimy muddines all the braunches that belong to the ſtomacke, the kall, and the neighbor parts. Neither can the Spleene be a fit receptacle for this melancholy iuyce, becauſe in it there are no hollow veines, whereas this thicke excrement would occupy a greater place then a thinne. Finally, there are no paſſages by which theſe lees might be thruſt forth, for it is not returned into the *hemorrhoidall* veines, nor into the bottome of the ſtomacke; becauſe if it were thruſt into the *hemorrhoidall* veines, then all men ſhould be trobled with hemorroids, becauſe all men haue this fœculent blood: adde hereto, that the blood that floweth by theſe veines is thinne and purple, not blacke and thicke. Againe, if the Spleene ſhould belch out the reliques of this fœculencie into the bottome of the ſtomacke, it ſhould at length bee auoyded either by vomit or by ſiege, and ſo we ſhould continually haue ſowre vomits or eructations, and black ſtooles.

Anſweres to the former arguments.

These and ſuch like are the arguments by which the aduerſaries of *Galens* opinion doe contend againſt him. But their blunt weapons will not faſten in the fleſh, *Nulla ſequitur de vulnere ſanguis*. For we anſwere, that the ſplenicke branch is a fit veſſell for the conueyance of this melancholy iuyce, from which although almoſt all the veines of the ſtomacke and the Kall doe ariſe: yet thoſe parts doe not draw into them this impure blood, but only the Spleene which by a kinde of familiarity challengeth it as his proper gueſt. So the kidneyes alone do ſucke through their ample veſſels the whay, not pure but mingled with the blood.

As for a cauity, we doe not thinke it neceſſary in the ſpleene, becauſe there are an infinite number of beds and webs of veines and arteries therein, in which the ſlime and muddy blood is boyled and attenuated: ſo in the Liuer there are many of theſe webbes and yet no cauity, as alſo in the breaſts and the teſticles. *Galen* in the 4. booke of the *vſe of Parts*, and the 6. Chapter, asketh the queſtion why there be two Kidneyes and but one bladder, and one ſpleene? he anſwereth himſelfe, becauſe the ſerous or whaey humour is in greateſt quantity, the choler leſſe, and the melancholy leaſt of all. The whay thinneſt, the melancholy

Galens obiections.

His owne anſwere.

cholý Lees thickeſt, and the choler betwixt both. And therefore for a little and thicke humor which was hard to be mooued, a great and rare organ was moſt fit; but it needed not to be hollow, becauſe the melancholy iuice was not ſodainly to bee remooued, but by degrees and length of time to be changed and altered. Now, if there be any reliques of this melancholy bloode, who will deny that it is auoyded by the Hemorrhoidall veines at the ſeige, or by the veinall veſſell into the bottome of the ſtomacke. Neither doth it hence follow, that the ſtooles ſhould be alwaies blacke, or the vomits ſowre; becauſe a little quantity of this fœculent blood by the heate of the inward parts may bee digeſted and ſpent in a vapour, as the excrements of the bones, the griſtles, & other parts. But if it abound as it happeneth in melancholy men, then the excrements of the belly, the bladder, and the hemorroid veines appeare blacke.

Why there is no notable cauity in the Spleene.

Tis true indeede, that ſometimes a right thin and purple bloode paſſeth away by the Hemorrhoides, becauſe the Leeches ſucke that which is thin, the thicker ſetling becauſe of the ſtreightneſſe of the wound: or els we ſay, that there are two kinds of Hemorrhoids, the one externall, the other internall; the internall ariſe from the ſplenick branch, and the externall from the Iliack: the firſt do euacuate ill diſpoſed and fœculent bloode, the other do empty the turged and full veines, and therefore the bloode that paſſeth from them is pure and lawdable.

External and internall Hemorrhoids

QVEST. XVI. *By what wayes the Melancholy iuice paſſeth from the Spleene to the bottome of the ſtomacke, and for what vſe.*

ALmoſt all Phyſitians do agree, that a part of the Melancholy humor is diſcharged into the ſtomacke, but by what paſſages and to what end, they cannot ſo well accord. *Auicen* thought, that it is carried vnto the mouth of the ſtomacke by the Coronary veine, before it enter into the Spleene. *Auicens* opinion. *Tis a ſtrange thing* (ſaith he) *that the light choler ſhould be ſent downeward vnto the guts, to redeeme the ſtomacke from his acrimony, and the heauie and dull Melancholy ſhould riſe vpward to the mouth of the ſtomacke for the commodity thereof.* *Galen* ſeemeth to haue thought diuerſly concerning this matter. In the third Booke of *Natural Faculties* he writeth, that it paſſeth from the Spleene vnto the Kall, thence into the guts, and by them to the *pylorus*, and at length to the bottome of the ſtomacke. In his Bookes of *the vſe of Parts*, he openeth a nearer way, to wit, the *Vas breue & venoſum*, that is, the ſhort or venall veſſell, reached from the vppermoſt branch neere the ſpleene to the bottome of the ſtomacke. *Galens.*

In his Booke of *the Diſſection of Veines and Arteries*, hee affirmeth that this ſhort veſſell is not found in all creatures. For mine owne part (ſaith *Laurentius*) I haue alwaies obſerued it neuer to be wanting. This paſſage therfore being ſo ſhort and conſpicuous, is moſt like to be ordained to conuey a part of the Melancholy iuice, which is like vnto the Lees of Wine into the bottome of the ſtomacke which could not be mittigated and attenuated by the power of the Spleene. Yet I will not deny but that when this ſhort veſſel is ſtopped the groſſe iuice returneth into the ſplenicke branch, and from it ſometimes into the Coronary veine of the ſtomacke, ſometimes into the Hemorrhoidall, and ſomtimes into the veynes of the Meſentery. But why ſhould this melancholy iuice bee ſent backe into the bottome of the ſtomacke? the common and true opinion is, that it is done to ſtirre vp appetite, for it is cold and ſowre; now all cold things becauſe they aſtringe or binde and corrugate or contract the mouth of the ſtomacke, doe prouoke appetite. So *Hippocrates* in *Epedimiis* ſaith, *That water is deuouring, and melancholy men are great eaters.* *Auicen* thought that this melancholy did not onely by his aſtriction ſtirre vppe appetite, but alſo further retention and concoction; and of the ſame minde is alſo *Galen* in the 5. booke *de vſu partium*, *It ſtreightneth the ſtomacke, & contracteth it into it ſelfe, and maketh it ſtreightly to embrace the meate, and to retaine it till it be concocted.*

What wee ought to thinke of it.

Why the Melancholy humor returneth into the bottome of the ſtomack.

Cold things prouoke appetite how. *Hippocrates.* *Auicen.* *Galen.*

If it be obiected, that if it ſtirre vp the appetite, Nature ſhould haue implanted the veinall veſſell into the mouth of the ſtomacke, which wee determine to bee the ſeate of appetite? We anſwere, that it is not ſo placed by the prouidence of Nature, leaſt continually gnawing and prouoking the mouth of the ſtomacke, it ſhould induce a perpetuall and rauenous appetite. By the benefit and help of this branch, thoſe who are diſeaſed with a quartane Ague (who for the moſt part haue it very large) are much eaſed by vomits, whether they come of themſelues, or are procured by Art both before and after the Poroxiſme or fit,

Obiection.

Anſwer.

How Quartane agues are often eaſed.

fit, eſpecially in the declination of the diſeaſe. This ſame branch alſo is the cauſe vvhy in Quartanes not onely the Spleene is affected, but alſo the mouth of the ſtomacke, yea, almoſt in all diſeaſes which proceede from Melancholy the Stomacke beareth a part of the burthen.

The ſtomack ill affected in quartanes.

QVEST. XVII. *How thoſe that are ſplenitick are purged by Vrine, and by what wayes thoſe purgations paſſe.*

Hippocrates calleth the Melancholie humor water.

THat all ſplenitick and melancholy perſons do abound with Vrine, as well the authority of *Hippocrates*, as alſo reaſon and experience doe perſwade. *Hippocrates* calleth the Melancholy iuyce *Aquam*, that is, Water; in his fourth Booke *de Morbis*, where he ſaith; *both the man and the woman haue foure kinde of moiſtures, Flegme, Blood, Choler, and Water.* And in his Booke *de genitura*, there are foure kindes of moiſtures, Blood, Choler, VVater, & Flegme. By water all Interpreters vnderſtand the melancholy humour, becauſe that of all humours hath moſt whay or vrine in it, for it is cold: wherefore when that aboundeth, the naturall heate of the Spleene, the Stomacke, the Liuer, and neighbour parts is waſted and diſſolued, from whence proceedeth a great encreaſe of crudities and waters. Adde hereto that it behoued this craſſe humour to haue much whay mingled with it, to be a weſtage or vehicle thereunto. Common and dayly experience addeth ſtrength to this opinion, for in quartane Agues there is much ſweate and much water made, and melancholy men are all of them *ſputatores maximi* great Spitters: therefore *Galen* out of *Diocles* in his 3. Booke *de locis affectis*, reckoneth aboundance of ſpittle to be the principall amongſt *Hypochondriacall* ſignes.

And why.

Much ſweate and vrine in Quartanes.

Melancholie men great ſpitters.

This therefore is to be reſolued of, that ſplenitick perſons doe abound with ſerous humour. Furthermore that it is purged by vrine, *Hippocrates*, *Galen*, *Auicen*, *Paulus*, and *Rhaſis* doe teach, and we finde it true in our dayly practiſe. *Hippocrates* in his Booke *de internis affectibus*, writeth that the medicines which are preſcribed to the ſplenitick perſons, ought to purge by the bladder; and in his Booke *de externis affectibus*, he willeth that thoſe choliricke Patients who haue great and turgid ſpleenes, and thereuppon are ill coloured or troubled with malignant vlcers, ſhould haue their vrine prouoked. The moderne Practitioners doe cure the vulcers called *ſceletyrbica*, which are contracted or gotten by the fault of the ſpleene, by *diuretical* and *diophoretical* medicines, that is, by ſuch as prouoke vrine and ſweate.

How to purge it.

Vlcera ſceletyrbica, how cured.

Hippocrates relateth an elegant Hiſtory of *Bion*, in the ſecond Booke of his *Epidemia*, and the ſecond Section. *Bion* (ſaith he) *did make much water without any reſidence, and the bloode yſſued out of his left noſethril; for his Spleene was puffed vp and hard.* *Galen* in his ſecond Booke *ad Glauconem* cures quartane Agues with Diureticall Medicines, ſuch as prouoke Vrine. *The guts* (ſaith he) *are to be purged by the ſeige but the Spleene and the Kidnies by the Vrine.*

Hippocrates ſtory of *Bion*.

Auicen.

The ſame *Galen* in his Commentaries in *ſextum Epidem.* writeth, that Blacke Vrines are ſignes of a colliquated or reſolued ſpleene. *Auicen Fen. 15. tertij. When ſplenitick perſons* (ſaith he) *do vſe much exerciſe, the Melancholy humor is deriued to the paſſage of the vrine, and the vrines become blacke.* And we our ſelues haue obſerued many ſplenitick perſons to haue recouered their health by a liberall and free profuſion or euacuation of blacke Vrines. But we muſt obſerue that ſuch Vrines are not blacke in their proper liquor, nor in their Generation (becauſe thoſe according to *Hippocrates* in his Prognoſticks, Prorrheticks & Aphoriſmes are all mortall, for that they bewray eyther an extraordinary heate, torrifying all things as it were into a blacke Cinder, or elſe an extinction of naturall heate, and a *Morticinium*, that is, an *vtter deadneſſe*) but they are blacke through a permixtion of a blacke humor, which the Spleene hath purged and put downe into the Kidneyes.

Experience.

Black waters. *Hippocrates.*

How Criticall waters becom black.

Now by what paſſages or wayes this *ſerous* and melancholy iuice is purged from the Spleene vnto the Kidneyes it is nor ſo eaſily knowne. There are two kindes of veſſels diſperſed through the ſubſtance of the Spleene: Veines ariſing from the ſplenitick braunch, and many Arteries.

The paſſages.

Betweene the ſplenitick branch and the emulgent veines, there is no communion vnleſſe it be a farre off; for the ſplenick branch ariſeth out of the trunke of the port or gate-veine, but the emulgent from the deſcending trunke of the *caua* or hollow veine: now betweene the hollow and the gate-veines wee know there is no communion vnleſſe it bee by the

the mingling of their mouthes in the ſubſtance of the Liuer; for ſome of the new writers haue obſerued many ſuch inoculations betwixt them in that place. Wherefore if the expurgation or auoydance of this melancholy humor be made by the veines, it muſt be returned from the ſpleene to the gate, from the gate to the hollow, and from the hollow to the emulgent veines, and ſo vnto the Kidneyes, which were a long and tedious courſe.

Our opinion therefore is, that this expurgation is rather made by the arteries then by the veines, becauſe the humour contained in the ſpleene, may by a nearer and more open paſſage be deriued from it vnto the emulgēt arterie. So the *Empyici, pleuritici et peripneumonici*, that is, ſuch as haue ſuppurations in their cheſt, are afflicted with the pluresie or inflamation of the Lungs, haue the matter or quitture euacuated not through the veins but through the arteries: and beſide, our eyes teach vs that there is more ſerous and whaey humor conteined in the arteries then in the veines. The moſt likly way.

And for this reaſon I thinke the emulgent arteries were made ſo large and ample, not ſo much to leade and bring down the vitall ſpirit (for if they had been but ſmall, they would haue ſerued that turne) as to purge the whay contayned in the arteries away by the kidnies: for ſo *Galen* teacheth vs in his 6. Booke *de vſu partium*, and in his Booke againſt *Eraſiſtratus*. And ſo much concerning the vſe of the ſpleen, & the way of the melancholy vnto the Stomacke and the Kidneyes. Nowe followeth that wee ſhould treate of the Kidneyes themſelues. Why the emulgent arteries were made ſo large *Galen.*

QVEST. XVIII. *Of the vſe of the Kidneyes, and the matter of the vrine.*

Eraſiſtratus and *Aſclepiades* as *Galen* witneſſeth in his Booke *de Naturalibus facultatibus*, aſcribed no vſe at all almoſt to the Kidneyes. *Ariſtotle* in his Book *de partibus Animalium*, ſuppoſeth that they were at the firſt intention ordayned to hold or conteine and eſtabliſh the veines, and that in the ſecond place or by the bye, Nature abuſed them for the excretion of a ſuperfluous humor. We with *Hippocrates*, *Diocles*, and *Galen* 1. *de naturalibus facult.* 5. *de vſu partium*, and in his Booke *de locis affectis*, doe thinke that they were framed for the expurgation or cleanſing of the veinall and arteriall blood. For whereas in the Liuer after concoction, there ariſeth a threefold excrement; one *bilious* or cholericke, another *fæculent* or melancholy, and the third *ſerous* or whaey; and the two former as ſoon as concoction is celebrated are purged away, but the third remaineth to conduct the thicke and ſluggiſh blood, that it might more eaſily and freely paſſe into the narrow and threddy veines: It was meet that at length hauing performed this his office, it ſhould alſo be ſeparated and purged as an vnprofitable ſuperfluity, and diſcharged into his proper receptacles. Theſe receptacles therefore are the Kidneyes, which is euident enough becauſe their ſubſtance is hollowed into diuers caues or dennes, and perforated or pierced through with many drayning pipes; as alſo becauſe of the continuity they haue with the great bladder of vrine by the mediation of the vreters. *Eraſiſtratus.* *Aſclepiades.* *Ariſtotle.* *Hippocrates.* *Diocles.* *Galen.* Of the vſe of the kidneyes. The vſe of the whaey humor

But how this expurgation is made, whether by the traction of the Kidneyes, or by the expulſiue power of the veines, or by the proper motion of the whay, or after what other manner, it is not yet fully agreed vpon. How vrine is made.

Eraſiſtratus conceiued that this expurgation came to paſſe by a neceſſary ſucceſſion of one part of that which was euacuated to another, that is to ſay for auoyding of vacuity. But we will not ſo much as vouchſafe any anſwere to this opinion. *Hippocrates*, *Diocles*, *Praxagoras* and *Galen*, 1. 2. and 3. *de facult. natural.* 4. *de vſu partium*, and 6. *de locis affectis*, doe all conclude that the kidneyes by a kinde of ingenit propriety, doe draw the whay vnto themſelues, not pure but mingled with bloud. The blood is there reſerued and applyed to the ſubſtance of the Kidneyes like a dew, after it is aſſimulated and turneth into their ſubſtance; but the whay being vnprofitable for nouriſhment, is firſt of all ſeparated, next becauſe of his thinneſſe is deriued through certaine fleſhy caruncles ſtrutting out like the nipples of breaſts, into very many pipes or fiſtules, and from theſe into a membranous hollownes, as it were into a Ciſterne, and out of it through the vreters into the bladder. *Eraſiſtratus.* *Hippocrates* opinion. *Diocles.* *Praxagoras.* *Galen.*

Some of the new writers haue thought this expurgation of the whay is not made by the Traction of the Kidneyes, but onely by the expulſion of the veines: becauſe nothing draweth, *propter ipſum trahere*, that is, *for the drawing it ſelfe, but that it may enioy that which it draweth*: but we know that the kidneyes are not nouriſhed with the whay neither with ſerous blood, becauſe their ſubſtance is denſe, ſolid, and compact, and the ſerous blood verie thinne New writers. Vrine auoyded by the expulſion of the veines. Their reaſons

thinne; and therefore the vrine is drawne to the veines, by the power and force of Nature, which is either burdned with aboundance thereof, or prouoked by his saltnes & acrimony.

That there is no expulsion at all.

There want not also some which defend the quite contrary, that there is no vse of expulsion in this expurgation, because then there should be a compresion of the veines and arteries, the vppermost being contracted and the lowermost relaxed, and by that meanes not onely the whay but also the whole masse of bloud should bee driuen downe into the Kidneyes.

1. Reason.

2. Reason.

Againe, the scituation of the Kidneyes seemeth to contradict this conceit of expulsion; for if that had beene their end, then their fittest position had beene directly vnder the hollow veine and the great artery, and not at the sides.

3. Reason.

Adde hereto, that this expulsion of the whay should not onely haue beene into the emulgent, but also into all the crurall and Iliac braunches, yea rather into the lower and neather vessels. And therefore this serous humour, say they, is neither drawn by the Kidneyes nor by them driuen, but of it own accord passeth vnto them, which passage some haue thought to be by accident, as *Erasistratus* of whose opinion we made mention euen now: others by it selfe, that is, by a proper faculty as *Auerrhoes* that acute Arabian, who thought that the Aliment was not drawne by the parts, but by an ingenite power and vertue of it owne did passe vnto them. For as in concoction the Aliment getteth a new forme, so it also getteth a new faculty, whereby it is moued to this or that particle of the body: so the Eliments by their proper formes are moued each to their proper place. But neither *Erisistratus* nor *Auerrhoes* can be approoued, because they both take away the faculties of the soule, especially the Tractiue which ministreth vnto nutrition.

Erasistratus.

Auerrhoes.

Comparison

Reconciliatiõ

We as our manner is, to reconcile the different opinions of these great learned men do say, That the Vrine is partly drawne and partly expelled; but the force of the Traction is greater then that of the expulsion. And yet wee affirme also, that some is onely expelled not drawne at all; and some againe neither drawne by the kidneyes nor expelled by Nature, but onely passeth on by a beaten way, which of long time it hath beene vsed vnto. The Vrine when it is naturall and no way tainted, and is onely the whay of the blood, is partly drawne by the Kidneyes, partly driuen by the expulsiue power of the veines, especially if all the frame of our naturall and legitimate health doe stand as they say in right tune: but yet in this expurgation the attractiue vertue of the Kidneyes is very great, and the expulsiue of the veines very light and weake.

For why should the whay rather fall into the Kidneyes then into any other part, vnlesse there were a peculiar Traction in the Kidneyes? In *Perirrhœa* or the Criticall fluxe of the Vrine, it is onely driuen and not drawne by the Kidneyes: but in a *Colliquation* it is neither driuen into the Kidneyes, because the expulsiue facultie is too weake, neither drawne by the Kidneyes, but as the Poet sayth, of the winde. *Qua data porta ruit.*

Where way is made,
It followeth glad.

The threefold matter of Vrine.

These things that they may be made more manifest and apparant, it shall not be amisse to bring them againe to the hammer and the anuile. The matter of the Vrine is very manifold: first all our drinke, sometimes raw and crude and of the same couler it was taken in, sometimes a little altered: secondly, the *serous* liquor of those humours which are contained in the veines: thirdly all kinde of humours, yea and bodies that are melted, as flesh and fat. This threefold matter *Hippocrates* comprehended in the first section of the 6. Booke *Epidemion*, where hee sayeth, *The Vrine is of the same couler with the meate and drinke, as well when it is as it should bee, as when it is a colliquation or melting of the moysture.* A wonderfull, short, playne, and yet absolute sentence, so as I think it vnpossible to expresse more in fewer words.

Hippocrates.

Why some thinke the drink the only matter of vrine.

Whereas he sayeth that the Vrine is of the same couler with the meate and drinke, it showeth the first matter of the vrine, to wit, the drinke which some haue thought to be the sole and onely matter, being perswaded thereto by these reasons. First, because those creatures which doe seldome or neuer drinke haue no bladders, but those that drinke much, do also auoyde much vrine. Secondly, because according to the rule of Physitians, the quantity of the vrine should be answerable to the drinke. Thirdly, because in the suppression of Vrine we interdict our Patients drinke, that the quantity of the vrine should not bee encreased. These things truely proue that the greatest part of the matter of the vrine is supplyed by the drinke and liquid meates; but they do not conclude necessarily that those are

Answere.

the

the onely and alone matter of it. For the infant auoydeth water in the Mothers wombe by the veſſell called *Vrachos*, yet it drinketh not; and againe in winter we make more vvater by much then in ſummer, and yet we drinke leſſe. And *Galen* in his firſt Booke *de locis affectis*, telleth a tale of a young man who euoyded as much water as came to foure *Heminæ*, that is, 36. ounces aboue a quart, and yet in three whole dayes hee had taken neither meate nor drinke.

The ſecond particle is (*when it is as it ſhould be*) whereby *Hippocrates* ſheweth the ſecond matter of the Vrine which is the true and legitimate matter thereof, and that is the whay of the foure Humors which are conteined in the Veines, and therefore *Galen* defineth the vrine, to be ὄρρον τῶν καλὰ τὰς φλέβας χυμῶν, that is, *The whey of the humor in the Veines*. As for *Lycus* the *Macedonian*, he is not to be harkened vnto, who affirmed, that the whay vvas onely the excrement of the Kidneyes. For how was it poſsible that ſo ſmall bodies as the Kidneyes are, ſhould beget ſo great a quantity of whaey humor? And if it be obiected, that *Galen* in ſome place hath ſaide, that the Vrine is the proper excrement of the Kidneyes and the bladder. We will anſwere, that it is therefore called proper, not becauſe it is engendred in the Kidnies, but becauſe it is drawne and ſeparated by them alone.

The ſecond matter of the Vrine, the whey of the foure humors

Obiection out of *Galen*.

Anſwere.

The laſt particle in *Hippocrates* expreſſeth the third matter of the Vrine, to wit, *All Humors and bodies which are melted or colliquated*: the humors are all of them purged by the vrine verie often, as in criticall euacuations by the bladder, in a purulent *perirrhæa*, and ſuch as is accompanied with a Strangury, or the Symptomes thereof. There remaineth vpon record cõcerning this matter a ſolemn edict of *Hippocrates* in the ſecond ſection of his firſt Booke *Epidemion*, where he ſaith, *Many doe auoid vrines bilious, watery, purulent, fretting, and ſtrangurious or yſſuing by drops*, becauſe as *Galen* interpreteth it, *The whole body did put downe by the vrines great abundance and varieties of euil humors*. But of this expurgation we ſhall haue occaſion to ſpeake in another place.

The third matter of the Vrine are the humors of the body.

Hippocrates.

Galen.

Neither are the humors onely, but alſo ſuch bodies as are colliquated and melted the matter of the vrine, ſuch as are fat and fleſhy: and hence come thoſe fat and oyle waters, when a conſuming Ague melteth the body, which are called ſignes of colliquation, whereof *Hippocrates* ſpeaketh in his prognoſtiques on this manner; *That Vrine is ill which is Oylie or fat when it is made*: now by Oylineſſe he doth not vnderſtand either the colour or conſiſtence of Oyle, but melted or colliquated greace ſwimming in the ſurface of the VVater. Concerning this threefold matter of the vrine, *Ludouicus Duretus* a great learned man of *France*, hath written at large in his elegant and learned Commentaries in *Coacas prænotiones* of *Hippocrates*.

Hippocrates.

What an oyly Vrine is.

Ludouicus Duretus.

The concluſion.

Theſe things therefore being ſo, and the matter of the Vrine ſo manifold, we conclude that all Vrine is not drawne by the Kidneyes, but that onely which is naturally diſpoſed, to wit, the whey of the foure humors contained in the veines. Notwithſtanding the Kidneyes are not therewithall nouriſhed, for all traction is not for nouriſhment: the Loadſtone draweth iron and amber chaffe, yet are they not nouriſhed by them. But the Vrine which hath for his matter crude humors or any other, which is freely & aboundantly poured forth on the criticall daies, we thinke is onely driuen and not drawne. But if the vrine do flow from the colliquation or Liquefaction, either of the humors, or of ſome more ſubſtantiall part, it is then neyther drawne by the Kidneyes, becauſe it is not *According to Nature*, neyther is it expelled by the power of the veines, becauſe there is a generall exolution or weakeneſſe of the ſpirits: but it paſſeth of his owne accord through moſt patent and ample veſſels to the kidnies, becauſe thoſe places are moſt accuſtomed to that euacuation. And this I take to be the ſum and ſubſtance of this Controuerſie.

QVEST. XIX. *That the reaſons of diuers Symptomes which follow ſuch as are afflicted with the Stone, are to be required for Anatomy.*

IT belongeth neyther to this place nor time to diſpute about the cauſes and generation of the ſtone, we rather ſticke to thoſe things that concerne Anatomy. But becauſe *Nephritical* patients, that is, ſuch as are troubled about their Kidneyes, eſpecially with the Stone, haue diuers accidents, wherof there can no reaſon be giuen but onely from Anatomy, I haue not thought it amiſſe briefely to lay them open with their ſeuerall cauſes for the ſatisfaction of ſuch as are not ſo well exerciſed in our Art, who notwithſtanding may deſire ſatisfaction in this point.

The

The *Nephritical* paine doth oftentimes immitate that of the Collicke, ſo that by the ſimilitude not onely the ignorant but ſuch as are right skilfull are often deceiued. Notwithſtanding they are diſtinguiſhed by their particular Symptomes, by thoſe things which are auoided, and thoſe that are applyed. The moſt greeuous Symptom of all the reſt is paine, which in the Collicke is wandering, but fixed in the Stone. The Collick paine aſcendeth like as the Collick gut aſcendeth, from the bottome of the belly to the ſtomacke, and ſo runneth vnder the bottome thereof; that of the Stone deſcendeth, becauſe of the continuity of the Vreters, eſpecially if the Stone begin to mooue. The Collicke paine poſſeſſeth all the lower belly, the Nephritick may be couered with ones hand; the Collick greeueth the region of the *Hypogaſtrium* and of the nauell, the Stone lyeth ſorer in the Loines backward.

Paine wandering & fixed.

Some haue obſerued out of the *Arabians* that the Collicke paine is leſſe when the Stomacke is empty, but the other then is exaſperated. And againe, when the ſtomacke is filled the Collicke encreaſeth, which muſt be thus vnderſtood. That the Collick paine euer abateth when the ſtomacke and guts are empty, but the Nephritick not alwaies; becauſe the ſtone lyes goading in the ſame place. Yet ſometimes after meate the nephritick paine is abated, becauſe if the ſtone be fixed in the Kidneyes the waight of it preſſeth downward, and thence the paine proceedeth; but when ſuch men haue eaten, the guts which ſupport and ſuſpend the Kidnies do ſwell, and ſo the paine is mittigated. There are alſo ſome Nephriticall paines which are exaſperated vpon the eating of meate, as when the Kidneyes are inflamed the diſtention of the ſtomacke and guts do encreaſe it. Againe, the paine of the Kidneyes beginnes dully, that of the Collicke is alwayes a cutting and a ſharpe paine.

An obſeruation out of the Arabians.

Obiection out of *Hippocrates*

If it be obiected, that *Hippocrates* in his Booke *de internis affectibus* affirmeth, that the pain of the Kidneyes is ſharpe; we may anſwere out of *Galen* that there is a double kinde of dulneſſe, the firſt is occaſioned by the Tartnes of the humor, or ſharpeneſſe and aſperitie of that which is contained, (imagine it to be grauell) and both theſe make the paine ſomwhat acute or ſtinging; the other is by reaſon of the waight when the Kidneys are oppreſſed with abundance. The paine which proceedeth from Tartnes and acrimony, is both in the generation, and alſo in the expulſion of that which offendeth: that which is from the weight taketh vp all the time betwixt the generation and the expulſion. Or thus, the paine of the Stone is dull whilſt it reſteth in the Kidney, and acute when it mooueth into or toward the Vreter. There are alſo other Nephriticall Symptomes; for the thigh that is on the ſame ſide wherein the ſtone lies, is as it were benummed or aſleepe, which is not ſo in the Collick paine, wherein the vomitings, loathings of meate, and diſtaſtfull belchinges are more frequent and greeuous; and ſo much of the ſymptomes.

Anſwere out of *Galen*.

2. Anſwere.

Another meanes to diſtinguiſh theſe paines.

Secondly, theſe paines are diſtinguiſhed by thoſe thinges that are auoyded; for in the collicke the excrements are more obſtinately retained, that not ſo much as a little winde can finde paſſage, but in the Nephriticall paine the vrine is rather ſuppreſſed. In the collicke paine the vrines are thinner in the beginning, and afterward become more thick; and if any winde or Flegme be auoyded, the paine is either mitigated, or elſe ceaſeth: but the nephritical is not appeaſed til the ſtone be auoided. Finally, thoſe thinges that are taken inwardly or applied outwardly, do diſtinguiſh theſe paines.

How the ſtone of the Kidnies is diſtinguiſhed from that of the bladder

Now the ſtone of the Kidneyes is knowne or diſcerned from that of the bladder by *The propriety of the paine, by the ſcituation, and by the dulneſſe*. The bladder is placed in the *Hypogaſtrium*, the Kidneyes in the Loynes; the generation of the ſtone in the bladder is without any ſenſe of paine, becauſe of the largeneſſe and capacitie of the bladder: in the kidneyes it is engendred with paine, becauſe of the narrowneſſe and ſtreightneſſe of the Kidney. In the ſtone of the bladder, the vrine is euermore ſuppreſſed not ſo in the ſtone of the Kidneyes becauſe there are two of them, that if one bee ill affected, the other might ſerue the turne. Againe, the Strangury and the *Teneſmus*, that is, the piſsing by drops and a vaine deſire of going to the ground, do alwayes accompany the ſtone of the bladder becauſe of the vicinity or neighborhood of the right gut, which is not ſo in the ſtones of the Kidneyes.

The grauell of the Kidnies red, and that of the bladder white.

Some there are which make a difference betweene them in regarde of the grauell, becauſe that of the Kidneyes is redder, that of the bladder whiter: the ſtone alſo of the Kidneyes is ſofter, that of the bladder harder. But this is not alwayes true, for the hardneſſe and heate of grauel are to be referred to the power or efficacy of the efficient, and the condition of the matter. And ſo according to the degree of heate the grauell is eyther white

or

or yellow or blacke, and according to the condition of the humour; when they are made of phlegme they are ash-coloured, and red when they are made of blood. But I may seeme here to haue grazed beyond my teather, I therefore returne.

The cause of the stupor of the thigh in the paine of the stone, out of *Langius* & *Iacotius*.

There are two *symptomes* which follow the *Nephritical* paine, a stupor or sleepines in the Thigh on the affected side and a Vomiting. The cause of this stupor, the learned *Langius* in his Epistles, and *Iacotius* in his Commentaries in *Coacas prænotiones* of *Hippocrates*, doe referre to the repletion of the veines. The large vesselles say they of the hollow veine and the great arterie as they discend downward, doe lye vpon the ridge of the backe, and from them there be notable branches scattered vnto the Kidneyes and the thighes, in whose repletion (which happeneth when the Kidneyes, the Vreters, or the emulgent vessels are obstructed) the nerues and the muscles are straightned, and thence that stupor or sleepinesse proceedeth. Confuted. But this reason seemeth not to me very *Anatomicall*; for the stone in the kidneyes doth not cause the veines so to strut that they should presse the muscles, because that many which are wasted with a consumption of the Lungs or some other part whose veins are exhausted, doe notwithstanding in fits of the stone feele this dulnesse or stupidity in their thighes or legges. Adde hereto, that those that are *plethoricall*, whose veines are turgid to the outward appearance, haue yet no such stupidity in the legges or armes. A double cause of the stupidity assigned. Wee must therefore finde out some other cause of this sleepinesse, and I thinke that it is double; the first is the compression of the muscle called ψοάς, vpon which both the kidnyes do rest, which also all Anatomists doe obserue to bee inserted into the inner part of the thigh, and appointed to bend the same. The other reason is the compression of the nerue which is diuersified into all the muscles of the thigh; and this compression is made by the hardnesse and waight of the stone, for while the stone is small and but a growing, this sleepines happeneth not.

Why the stomacke is subuerted in the fits of the stone.

Now the reason why in the fit of the stone there is so great a subuersion or turning of the stomacke, that the Patient loatheth all meates, and presently casteth vp whatsoeuer hee receiueth, is the sympathy or consent betweene the stomacke and the kidneyes; and the cause of this sympathy which is simple, is not to be referred to their vicinitie or neighbourhood, because there is a good distance betweene them, not vnto the similitude or likenes of their kindes or substances, for the stomacke is membranous and the kidneyes fleshy; not vnto the society or entercouse of their operations, for they are not occupyed about one & the same labor; it is therefore to be referred to the communion and continuation of their vesselles and membranes. For there are certaine small nerues which are carried from the stomack nerue to the kidney; and the outward coate inuesting the kidneyes which is commonly called *fascia* or the *swath*, hath his originall from the *Peritonæum* or rim of the belly, which all men know is continued with the bottom of the stomacke.

QVEST. XX. *Whether the bladder doe drawe the Vrine.*

Whether the bladder haue any tractiue faculty. *Galen.*

COncerning the Tractiue, Retentiue, and Expulsiue faculties of the Bladder, in respect or reference to the vrine, there are some small difficulties which had neede to be made plaine. And first there may bee question made of a Tractiue faculty, for *Galen* sometime alloweth, sometime denyeth it. In the third Booke *de natural. facult.* and the fift *de vsu part.* he writeth that both the bladders of the gall and of the vrine haue a proper power to draw their owne excrement. And this the structure or frame of the bladder doth also conuince, for it appeareth to be wouen of three sorts of fibres, right, oblique and transuerse. *Galen.* And in the 7. Chapter of the 5. Book *de vsu part*: *The Bladder sayeth Galen, as well that which receiueth the vrine as that which receiueth the Choler, because both of them doe draw their proper excrements pure and segregated from the rest, do both of them by due right make claime vnto other vesselles which should conuay nourishment vnto them.* *Aristotle.* *Aristotle* in the 15. Chapter of the third Booke *de histor. Animal.* sayeth, *That after death no humour falleth into the bladder, but whilst men are aliue not onely humour, but also dry recrements doe passe downe, of which stones are ingendred.* Nowe if the whay did only discend and were not drawn, why should it not discend also in dead bodies? *Galen.* *Galen* in the 6. Booke *de locis affectis*, seemeth to be of a contrary opinion. For searching into the nature of the disease called *Diabetes*, that is an exceeding fluxe of vrine, and the causes thereof, he affirmeth, that the bladder doth not draw the vrine vnto it selfe. But I vnderstand *Galen* that where he sayth in the *Diabetes*, *The bladder draweth no whay vnto it selfe*, his meaning is, that the cause of the *Diabetes* is not to be referred to the Tractiue power of

The cause of *Diabetes*. *Galen* expounded.

the

the bladder,neither that it is at all any affection of the bladder, but rather a ſymptome of the exceeding ſtrength of the Traction of the Kidneyes,and of the weaknes of their retention, and therefore in that diſeaſe the bladder draweth not ſo great a quantity of vrine, but the hot and boyling Kidneyes draw more whay then they are able to conteyne,whence either of it owne accord it falleth through the vreters into the bladder, or is thruſt downe by violence.

How the bladder is nouriſhed.

But if all things ſtand in good order according to the lawes of Nature, then there is no reaſon but to think that the vrine is drawne by the vreters and the Bladder. Neither doe I thinke that the bladder is nouriſhed by that excrement,conſidering that from the *Hypogaſtricke* branch there are many ſmall rillets of veines and arteries diſperſed through both his Coates.

QVEST. XXI. *Of the Retention and Excretion of the Vrine,whether it be accompliſhed by a Natural or by an Animal faculty.*

Retention & excretion are natural actiõs

THE proper vſe of the Bladder is to retayne the Vrine to a certaine time, and afterward to auoyde it; but by what power it doth this,Animall or Naturall, there lyes the controuerſie. Some conceite that both the actions, as well the Retention as Expulſion are Naturall, becauſe there is the ſame reaſon of both the bladders of gall and of vrine, but the bladder of gall reteineth and expelleth onely by the faculty which we call Naturall. Adde hereto that the triple kinde of fibres which are in both the bladders doe perſwade vs that there is a threefold Naturall action in them and not an Animall. On the contrary, it may bee demonſtrated that both theſe actions are Animall on this manner.The Retention is made by Animal inſtruments, and therefore the action is Animall,this Animall inſtrument is a muſcle. Now we know that the necke of the bladder is compaſſed about with a *ſphincter* muſcle, who playes the Porter and ſtoppeth the gate leaſt the Vrine ſhould paſſe away without our good pleaſure.

That they are animall.

That the Expulſion is Animal is witneſſed as by other arguments,ſo by this,that according to our arbitrary wil it is either ſlower or quicker, weaker or ſtronger,as alſo becauſe it is not acompliſhed without the help of the muſcles of the *Abdomen*. *Galen* in his firſt Book *de locis affectis*,and 6. Chapter,ſtinteth this ſtrife,and ſayth that the action is mixt; the Retention, Animall, and voluntarie,as being performed by the helpe of a muſcle,the Excretian Naturall which is vndertaken and performed by the expulſiue faculty: For my owne part I thinke that both actions as well the Retention as the Expulſion,as partly Naturall & partly Animall,but the Retention more Animall,and the Expulſion more Naturall. The Vrine is retained in the bottom of the Bladder by the help of the oblique fibres; now that Retention is naturall;but beſide it is retayned alſo at our pleaſure by the helpe of the *ſphincter* muſcle,and this action is meerely Animall. The vrine is Expelled by the ingenite power of the Bladder,whereby it is prouoked to auoyde that which is noyſome or grieuous vnto it,& this Excretion is altogether Naturall. Again, the Vrine is Expelled at our pleaſures by the help of the muſcles of the *Abdomen* preſsing the *Hypogaſtrium* or water-courſe; and ſome thinke that thoſe ſmall muſcles of the *Abdomen* called *Pyramidales* or *ſuccenturiati*, that is, ſpirie or aſsiſtant muſcles were ordained by Nature to further the excretion of this humour,and therefore both theſe actions are mixed.

Galen.

What our reſolution is.

The vrine.

Obiection. Anſwere out of *Galen*.

Some will obiect that excretion can be no way naturall, becauſe all naturall actions being perpetuall and indeſinent the vrine ſhould bee continually auoyded. *Galen* anſwereth that all vrine is not the obiect of the expulſiue faculty,but that onely which either fretteth or ſtreatcheth, that is,which is offenſiue either in quantity or in quality: and ſo much concerning the Bladder; now follow the Paps.

QVEST. XXII. *Of the action and vſe of the Breaſts or Paps.*

The queſtion

ALL men I think are reſolued that there is in the Breaſts an in-bred faculty of making Milke. This onely is queſtionable,how they which are but kernels ſhould performe an officiall or common action, which is accompliſhed by alteration and concoction; ſeeing *Galen* denyeth vnto theſe glandules all action and yeeldeth vnto them onely a vſe. Now that the Breaſts or Paps are to be reckoned among the glandules,their ſubſtance and vſe doe manifeſtly declare. For their ſubſtance it is rare, friable, and ſpongy; and for their vſe *Hippocrates* in his Booke *de*

Galen. The breaſts glandules. *Hippoorates.*

Glan-

Glandulis aſcribeth the ſame vnto the Dugges which other kernelly parts performe, where he ſaith, *The Vſes of the Paps and of the Glandules before mentioned are alike, for they all ſucke vp the ſuperfluities of the whole body.*

For the Solution of this Queſtion, we ſay there are two kindes of Glandules, for vvhich we haue *Galen* our Author, in his ſecond Chapter of the ſixteenth Book of the *vſe of parts*. There are ſome Glandules which are ordained onely to eſtabliſh and vnder-prop the Veſſels, or to receiue ſuperfluous humors, or to water and moyſten the parts. There are others which are prouided by Nature for the generation of certaine iuices or humors which are profitable for the creature. The former haue neyther Veines, nor Arteries, nor ſinnewes: theſe latter haue very conſpicuous veſſels, and are of exquiſite ſenſe. The former are properly called Glandules; the latter may better be ſtiled Glandulous bodies. So the Teſticles and the Kidneyes by *Galen* are called Glandulous bodies; and *Hippocrates* in his Booke *de Glandulis* ſaith, that the braine it ſelfe in reſpect of his ſubſtance is glandulous. The former are onely of ſome vſe, the latter affoord both vſe and action, amongſt which wee conclude the dugs or breaſts to be.

The ſolution of the queſtiõ *Galen.*

Two kindes.

Galen. *Hippocrates.*

And whereas *Hippocrates* ſaide, that theſe dugs doe receiue or ſucke vp an excrementitious humor, we vnderſtand that this is not there primary or chiefe and maine vſe, but onely ſecondary: for Nature often abuſeth one and the ſame part to diuers vſes; ſo the braine in manner of a *Glaſſe-ſtill* or *Cucurbita*, doth draw and ſucke vp the expirations of the lovver parts, and yet notwithſtanding there is another and more diuine vſe of the braine. So nature often abuſeth the guts for the expurgation and vnburdening of the whole body, whereas they were Originally ordained for another purpoſe, to wit, for diſtribution of the Chylus.

Hippocrates ex pounded.

The Braine Glandulous.

The Breaſts therefore or Paps haue a proper action and vſe. Their action is the generation of Milke, which is performed by a moderate and equall coction or boyling. Their vſes are either primary or ſecondary: The primary vſe *Galen* ſaith is for generation of milk, but *Ariſtotle* would haue them ordained for the defence of the heart, the moſt noble of all the bowels; and I thinke he was miſſled with this argument, becauſe men had breaſtes, and yet did not ingender milke. Wee with *Galen* do determine, that theſe glandulous bodyes compaſſed with fat, and wouen with many thouſand veſſels, were firſt and originally ordained for Milke, and are not alike in men and women. And yet I conceiue that they were ſcituated in the breaſt rather to add ſtrength to the noble parts conteined vnder them, then for the generation of Milke. For in moſt creatures they make Milke not in the breſts but in other parts.

The primarie vſe of the breaſts.

Galen. *Ariſtotle.*

Galen.

You ſhall therefore reconcile *Galen* and *Ariſtotle*, if you ſay, that the Dugges were created originally for the generation of Milke, and ſecondarily for the ſtrengthning & defence of the heart. And againe, that the originall cauſe of their ſcituation in the breaſt was for the defence of the heart, and the ſecondary for the generation of milke.

Galen and Ariſtotle reconciled.

QVEST. XXIII. *Whether Milke can be generated before conception.*

IT was diſputed of old, and is yet a queſtion amongſt the multitude, whether Milke can be engendred in a womans breaſts before ſhe haue had the company of man and conceyued. And this doubt is occaſioned by ſome different places in *Hippocrates* and *Ariſtotle*. *Hippocrates* in his firſt Booke *de Morbis mulierum*, inquiring after the ſignes of the *Mola* or Moon-calfe, reckoneth this as one of the principall, *When in the Breſts there is no Milke engendred*. And therefore the generation of Milke is according vnto *Hippocrates* a certaine ſigne of conception. *Ariſtotle* in his Bookes *de Hiſtoria Animal*, confirmeth the ſame, where hee ſayth, *That no Creature engendereth Milke before the womb be filled.*

Hippocrates. *Ariſtotle.*

And reaſon ſeemeth to conſent with their authority. For if nature do neuer endeuour any thing rathly, but all things for her proper end, what neede is there of Milke before the infant be perfected, it beeing onely ordained for the nouriſhment thereof? Notſtanding *Hippocrates* in his Aphoriſmes ſeemeth to be of a contrarie minde. *If a woman* (ſaith he) *which is neither big with childe, nor hath yet conceyued, haue milke in her breſts, it is a ſigne that her courſes are ſtopped*. And *Ariſtotle* in his Bookes *de Hiſtoria Animal*: affirmeth, that Milke may be bred in the breſts or dugs of men which alſo *Albertus* and *Auicen* do witneſſe.

Hippocrates. *Ariſtotle.* *Albertus.* *Auicen.*

A Storie out of *Cardanus.*

Hieronimus Cardanus in his Bookes *de ſubilitate* ſaith, that hee ſaw a man about thirtie

The men of *America* haue milk in their breaſts.

foure yeares old, out of whoſe breaſtes ſo great a quantity of Milke did flow, that it was almoſt ſufficient to nouriſh a childe. They that haue trauailed into the new world do report that almoſt all the men haue great quantity of Milke in their breaſts.

If therefore men doe breede Milke, much more Virgins and Women before they doe conceiue. For their Dugs are more rare and large, and beſide they haue a greater aboundance of ſuperfluous bloud; Reaſon alſo fauoureth this opinion, for where the materiall cauſe of Milke is preſent, and the ſtrength of the efficient not wanting what ſhould hinder the generation thereof? Now in Virgines that bee of ripe yeares, the veines of the Cheſt which water the Dugges haue great aboundance of bloud, they haue alſo the ſtrength of the glandules to alter and to boyle it: for after the fourteenth yeare, *The Dugges* ſayth *Hippocrates doe ſwell and the Nipples ſtrut*, and young wenches are then ſayd κυαμίζειν, that is *fratrare*, to grow together like twinnes. Wherefore Milke may ſometimes be bredde, in ſuch women eſpecially whoſe courſes be ſtopt as *Hippocrates* writeth. But theſe diſagreeing places of *Hippocrates* it will not bee hard to reconcile out of *Hippocrates* himſelfe. There is a double generation of Milke according to *Hippocrates*, and a double nature thereof. One kinde of Milke is true and laudable, another not true nor perfectly boyled. The former is made by a great alteration and true concoction of the breaſtes, and that not priuate but officiall; the latter ariſeth of a remainder of the proper nouriſhment of the breaſts; the firſt is perfectly white, ſweete, and moderately thicke, and fitte to ſuckle an Infant; this other is white indeed becauſe it beareth the colour and forme of the part from whence it floweth, but it hath neither the true nature of a nouriſhing *Chymus* or *humour*, nor the ſweetnes nor the power or vigour of nouriſhment, and therefore it deſerueth the name of Milke, not by his quality or ſpecificiall forme, but onely for his colour, for it is thinne and wateriſh, altogether vnprofitable to nouriſh an Infant. The former is begotten by the expreſſion and refluence of the blood from the wombe to the dugges, as alſo by traction: this latter onely by the Traction of the proper Aliment; the former cannot be generated before true conception, becauſe there ſhould be no vſe of it before. The latter may bee ingendered in growne & ripe maydens, and well blooded men, whoſe bodies and veſſels do abound with laudable iuyces. This double kinde of generation of Milke, I gather out of *Hippocrates* his Bookes *de natura pueri & de glandulis*. *The Nature ſayth hee of womens breaſtes is very rare and ſpongy, and the Aliment which they draw vnto themſelues they turne vnto Milke.* This is the firſt kinde of generation.

Reaſons.

Hippocrates.

A reconciliatiō out of *Hip.*

Two kinds of milke according to *Hip.*

Hippocrates.

The other he deſcribeth in the ſame place. *The Milke commeth from the wombe to the breaſts, which after the birth muſt be the nouriſhment of the Infant: this the Kel preſſeth out and ſendeth vpward, being ſtraightned by the growth of the Infant.* Wherefore the blood is preſſed or ſtrayned, and ſo returneth in women with Child by a wonderfull prouidence of Nature from the wombe to the Pappes, and that as ſoone as the Infant begins to moue. After it is brought into the world there is no more expreſſion made, but the blood floweth of it owne accord to the Pappes, according to his accuſtomed motion, which *Hippocrates* ſheweth in theſe words, in his Booke *de natura pueri*. *After a Woman hath borne a childe, if ſhee alſo haue giuen ſucke before, the Milke wil ariſe into the breaſtes as ſoone as the Infant begins to moue*: ſo that after the birth it is therefore led vnto the breaſtes, becauſe it was accuſtomed to bee his courſe that way all the while the Infant did moue in the mothers wombe. Neither doth the blood onely of it owne accord preſſe vnto the Pappes, but they alſo drawe a greater quantity then is ſufficient for their peculiar nouriſhment.

How the milk commeth vnto the breaſts, and why.

Hippocrates. The firſt generation of milk

Of this Traction there bee diuers cauſes; the Infants ſucking, the largeneſſe of the veſſels, the motion or exerciſe of the dugs, and at length the auoyding of vacuity. For when the veines of the breaſts are exhauſted by the Childs inſtant ſucking, then they draw bloud vnto themſelues from euery ſide.

Wee conclude therefore that true Milke and perfectly concocted is not generated before conception, but that there may be a thinne and raw Milke ſometimes made of the reliques of the proper nouriſhment of the dugs.

QVEST. XXIIII. *Wherein certaine Problemes are vnfoulded concerning the generation of Milke.*

COncerning the firſt generation of Milke, there is vpon record a ſolemne edict of *Hippocrates* in his Booke *de natura pueri*. *As ſoone as the Infant beginneth to moue, the milk giueth warning thereof vnto the mother.* For the explication of which ſentence, there

are

are two Problemes to bee discussed. The first, why at that time the Milke should begin to be generated. The second why the infant should not be nourished out of the wombe with the same wherewith hee was nourished in the Wombe. The resolution of the first question will haue some difficult passages in it. For seeing that the Milke is onely ordained for nutrition, and that therewith the infant in the womb is not nourished, but onely after the birth, why is the Milke generated before the seauenth month, til when there is no vse of it, or why doth it not flow from the womb to the brests presently, or soone after conception, as well as in the third and fourth months. *Hippocrates* in the Booke before quoted, answereth this Question thus, *That the infant in the third or fourth month becomming great, dooth straine or presse the vessels which are full of bloode, and by this compression there is an expression made vnto the vpper parts.*

Why the milk is generated the 3. or 4. moneth.

Question. *Hippocrates.* Solution.

This reason is indeede very true, but verie subtle and obscure, wherefore we wil paine our selues a little to make it manifest. In the first months, Natures expence of blood is very great. First of all, because the *Parenchymata* or substance of the bowels and all the fleshy parts are generated, and afterwardes for the nourishment and growth of them all, so that there remaineth little or no ouer plus of the Mothers bloode. But when the infant beginnes to moone because there is alreadie a perfect conformation of all partes, Nature thereafter onely entendeth nourishment, which nourishment requireth but a small quantity of Aliment, because there is but small and slender exhaustion or expence in the parts, and therefore in the veynes of the Wombe, there must needes be an ouer-plus of bloode: these Veines being pressed by the motion and weyght of the Infant, which now is growne great, doe driue the blood vnto the vpper parts, and rather into the Dugges then into any other, as well because of the commodiousnesse and fitnesse of the way, as because of the societie and simpathie that is betwixt the wombe and the breasts. Add heereto a third cause which also is the finall, and that is the wonderfull prouidence of Nature, whereby the blood is accustomed by little and little to be transported vnto the place where it shall bee turned vnto Milke, and so remaine a plentifull fountaine for the nourishment of the infant after it is borne into the world.

A darke sentence of *Hippocrates* explained.

Why the blood returneth from the wombe rather to the Dugges then to any other part.

The prouidence of Nature.

And that is the reason why women are not so much troubled with bleedings at the nose, and with Hæmorrhoides, because bloode affecteth the way vnto the wombe, to satisfy the ende or intent of Nature, which is the generation and nourishment of an infant. Giue mee leaue also to giue another reason of this refluence of bloode from the Wombe vnto the Dugges, which is, That the infant might haue occasion offered it to seeke a way out of the Wombe. For, if all the blood were still reserued in the vessels of the wombe, and no part of it discharged or sent away other whether, the Child would neuer striue to come foorth, hauing alwayes nourishment enough at hande to content it: for *Hippocrates* saith, that the onely cause of the strifte of the Infant in the byrth is the vvant of Nourishment.

Why women bleed not at the nose, nor are troubled with Hæmorhoids.

Hippocrates. The true cause of the trauel.

It behooued therefore, that in the thirde and fourth Moneths Nature should by degrees transferre the bloode vnto the Dugges to accustome her selfe to leade it thether for the nourishment of the Infant when it is borne, as also to defraud the infant nowe becom'd better growne of his nourishment, whereby hee might bee prouoked to seeke for it other where. Some thinke, that the blood returneth vnto the brests after the infant beginnes to moone, to bee kept as it were in store, that thereby at time of neede, and in great want the infant might haue blood so prepared and whitened into Milke to sustain his necessity.

And this *Hippocrates* seemeth to intimate in his Booke *de Natura pueri*, where he saith, *That the infant with this milk, is somewhat, and sometimes norished*, which saying of *Hippocrates* I do thus interpret, *The childe is nourished with milke*, that is, with the blood conteyned in the veines of the dugs, which is the next and most immediate matter of the milke, or, if the infant should bee extreamly affamished before the time of the birth, I thinke that the white milke may returne from the paps to the vessels, and be there boiled and conuerted into blood by the sanguifying vertue of the veines, which is neuer idle or asleepe. And that the milke may returne from the paps vnto the vessels, and be againe altred into blood, is approoued by the daily experience of nurses and women in child-bed.

Hippocrates expounded.

The second Probleme was, why the Infant is not nourished with the same Aliment without and within the VVombe; for within the wombe it is nourished with verie pure bloode, vvithout the wombe with sweete milke. *Dinus* answereth, That the bloode being

The second probleme.

Dinus answer.

hotter then the Milke, if it ſhould paſſe all the three concoctions in a childs bodie, it would at length become vnmeete for nouriſhment, becauſe by too much heate it would contract a bitterneſſe: but the Milke which is of a more cold temper is more eaſily mittigated, and groweth rather ſweete then bitter by the three-fold concoction. But is it rather an inhumane and beaſtly thing for children to be blood-ſuckers: or ſhall we ſay that therefore the Infant after byrth is not nouriſhed with bloode, leaſt by his ſucking hee ſhould open the the mouths of his Mothers Veines, and ſo the blood which is the treaſure of nature ſhould flowe away.

Another anſwere.

Obiection.

And whereas ſome affirme, that after wee are born, it is neceſſary that our Aliments ſhould paſſe all three concoctions, and that it is not poſsible that the ſtomacke ſhould chylefie the blood, and therefore Infants are not nouriſhed by bloode but by milke: I ſay this reaſon is falſe and full of error, for whatſoeuer is taken vnto the ſtomacke, if it may be aſsimulated, it may alſo be turned into a creamy ſubſtance, and many there be who drinke the blood of Swine and Goats, the noyſome excrements whereof are auoyded by the guttes and the ſeidge. Now the excrements of the guts, are onely excrements of Chylification.

Anſwer.

The concluſion of theſe controuerſies

Other things which may concerne this or anie other of the Naturall parts which belong vnto Nutrition, becauſe wee imagine that they are eaſilie knowne, or if hard yet generally agreed vpon, we do willingly paſſe ouer, iudging it ſufficient that we haue thus long detained the Reader in theſe Labyrinthes of Controuerſies, which notwithſtanding as it may be they will not be thought neceſſary for all, ſo we preſume that they wil not be irkeſome to any man, whoſe Stomacke ſtandeth to theſe delicacies of Nature, nor vnprofitable for thoſe to whoſe proper element they belong. Now it is high time to returne to our Anatomical Hiſtory of the Natural Parts belonging to Generation.

The End of the Controuerſies of the Third Booke.

THE FOVRTH BOOKE

Of the Naturall Parts belonging to generation, as well in Men as in VVomen.

The Præface.

BEing ariued at this place in the tract of my Anatomicall Perigrination, I entred into deliberation with my ſelfe, whether I were beſt ſilently to paſſe it by, or to inſiſt vppon it as I had done in the former. On the one ſide I conceiued my labour would be but lame if it wanted this limbe, and a great part of my end and ayme fruſtrated, it being to exhibite the wonderfull wiſedome and goodneſſe of our Creator, which as in all the parts it is moſt admirable, ſo in this (if perfection will admit any degrees) it is tranſcendent. The whole body is the Epitomie of the world, containing therein whatſoeuer is in the large vniuerſe; Seede is the Epitomy of the body, hauing in it the power and immediate poſſibility of all the parts. Moreouer, the knowledge of theſe principles of generation is ſo much more neceſſary toward the accompliſhment of our Art, by how much it is more expedient that the whole kinde ſhould be preſerued then any particular. Adde hereto, firſt that the diſeaſes hence ariſing, as they bee moſt fearefull and fulleſt of anxiety eſpecially in the Female ſexe, ſo are they hardeſt to be cured: the reaſon I conceiue to be, becauſe the partes are leaſt knowne as being veyled by *Nature*, and through our vnſeaſonable modeſty not ſufficiently vncouered. Againe, the examples of all men who haue vndertaken this taske euen in their mother tongues as we ſay, did ſway much with me whoſe writings haue receiued allowance in all ages and Common-wealths. On the contrary there was onely one obſtacle; to reueyle the veyle of *Nature*, to prophane her myſteries for a little curious skil-pride, to enſnare mens mindes by ſenſuall demonſtrations, ſeemeth a thing liable to heuy conſtruction. But what is this I pray you elſe but to araigne vertue at the barre of vice? Hath the holy Scriptue it ſelfe (the wiſedome of God) as well in the old Law particularly, as alſo in many paſſages of the new, balked this argument? God that Created them, did he not intend their preſeruation, or can they bee preſerued and not knowne? or knowne and not diſcoured? Indeede it were to be wiſhed that all men would come to the knowledge of theſe ſecrets with pure eyes and eares, ſuch as they were matched with in their Creation: but ſhall we therefore forfet our knowledge becauſe ſome men cannot conteine their lewd and inordinate affections? Our intention is firſt and principally to inſtruct an Artiſt: ſecondarily that thoſe who are ſober minded might knowe themſelues, that is, their owne bodies, as well to giue glory to him who hath ſo wonderfully Created them; as alſo to preuent thoſe imminent miſchiefes to which amongſt and aboue the reſt theſe parts are ſubiect. As much as was poſſible we haue endeuoured (not fruſtrating our lawfull ſcope) by honeſt wordes and circumlocutions to molifie the harſhneſſe of the Argument; beſide we haue ſo plotted our buſines, that he that liſteth may ſeparate this Booke from the reſt and reſerue it priuately vnto himſelfe. Finally, I haue not herein relyed vppon my owne iudgement, but haue had the opinon of graue and reuerent Diuines, by whome I haue bin per-

Arguments perſwading vs to proſecute the hiſtory of theſe parts.

Obiection anſwered.

How cautelous we haue been herein.

perſwaded not to intermit this part of my labour. My hope therefore is that my paynes in this part ſhall receiue not onely a good conſtruction, but alſo approbation and allowance of all thoſe that are indeed wiſe. As for ſuch as thinke there is no other principle of goodneſſe then not to know euil, I would wiſh them to learne of their horſes, that it is no good mannage to ſtand ſtocke ſtill but to moue in order. We will apply our ſelues to our buſineſſe.

The perfection of euerie thing is perpetuity.

The greateſt argument of diuinity, or of a nature reliſhing thereof is perpetuitie and immutability, the perfection whereof as it is incompetent to any compound creature (for the ſoule is therefore immortall becauſe it hath no parts) ſo it is moſt reſembled in that we cal *Life*; wherein there is a perpetuity though not of all the parts of time *Paſt*, *Preſent*, and *to Come*; (for Time is the meaſure thereof) yet of that which in time is ſubſiſtent, that is the *Preſent*. For as the production of poynts perpetuateth a line, ſo the coherence of *preſent* times make a kinde of eternity. Life therefore ſo long as it is prolonged hath no end, and may be compared to a clew of yarne, ſuch as the Poets faigned the Deſtinies to ſpin, which ſo long as there is flaxe to ſupply, may be drawne into an endleſſe length. Now wee muſt know that the matter of all things is eternall for it neuer periſheth, elſe had the world long agoe beene anihilated. The diſſolution of created things is but a reſolution of one thing into another; hence comes the perpetuity of all things though ſubiect to alteration, a perpetuity I ſay, not of the ſame particular thing diſtinguiſhed by one and the ſame forme, but of the Elementary parts whereof it was compounded.

What life is.

Compariſon.

The Elementary forme of man.

But ſome will ſay, this is but a ſpeculatiue & imaginary perpetuity, ſhew it vs more really that we may ſee it with our eies, & feel it with our hands. I ſhew it thus. The body of man conſiſteth of matter and forme; by forme I mean, not the ſoule, but the forme ſubſiſting in the matter, and ariſing out of the power of the ſame, which though it be not diuine nor ætheriall as ſome imagine, but meerely materiall, yet ſo neere it approacheth to the puritie & nature of the firſt matter wherout it reſulteth, that it eaſily vaniſheth into an incompounded principle, ſubſiſting afterwards in Nature, not as a forme being forſaken by the ſpirite wherein it had his reſidence and whereby it was nouriſhed, but as a part of the vniuerſall Nature.

How a man is perpetuall.

This forme we call Life, which as it is raiſed out of the matter of the body, ſo it continueth ſo long therein, as it is ſupplied with nouriſhment, which nouriſhment is the radicall moyſture of the ſpermaticall parts. Nature therefore being not able to generate anie part of ſeede whoſe moyſture ſhoulde not in time bee exhauſted, could not produce any particular creature eternall or immutable: notwithſtanding ſhe deuiſed a way by framing parts fit for multiplication of ſeede, to raiſe a perpetuity, though not of any particular *individuum* yet of the kinds of all creatures. Thoſe partes are the ſubiect of our preſent Diſcourſe.

The proceſſe of Nature in the Frame of Man.

So then firſt of all ſhe prepareth a matter euen the ouer-plus of the nouriſhment of the particular parts of our bodie. For the nouriſhment hauing ariued at the parts, and receiued an impreſsion or ſtampe of their nature, is partly aſsimulated into their ſubſtance, partly (at leaſt if there be any ouer-plus when the part is ſatisfied) falleth backe by the Veſſelles vnto the ſpermaticall Veines and Arteries, which receiuing an irradiation from the Teſticles to which they are continued, do giue that matter a kinde of rudiment of ſeede. The lower it fals and the nearer it approacheth to theſe Teſticles, the better is it ſtill laboured, till in the end it receyue from them his vtmoſt perfection both in the colour, conſiſtence, and prolificall vertue; being ſo accompliſhed, it is conueyed by the leading veſſels into the Store-houſe called *Proſtata*, where it is tunned vp and reſerued for the generation of a new creature, which new creature when it is made, is alſo able to affoorde matter for the generation of another, & ſo nature obtained a perpetuity and eternity euen out of mutable and temporary principles.

Compariſon.

The like adminiſtration of Nature (though the proceſſe of her worke bee not ſo long) we ſee in fruites, and trees, and plants, all of them being able to bring foorth ſeede, which ſhall perpetuate their kindes, a ſeede (I ſay) which though it bee but ſmall, ſhall conteine in it a power to frame anew all the parts of the bodie from whence it yſſued. So an Acorne hath in it the power of a mighty Oake. The quantity of an Emmet of ſeede, the power to grow into a vaſt Elephant. But becauſe whatſoeuer is ordained to bee made a liuing creature, muſt haue not onely one principle whereof it ſhould bee formed, but alſo another whereby it might bee ſuſtained and nouriſhed, as alſo a conuenient place for the growth

growth and extenſion thereof: Nature therefore(vnder which name I alwayes vnderſtand the wiſe adminiſtration of Almighty God) made another ſexe of mankinde, not altogether of ſo hot a temper or conſtitution, becauſe ſhe ſhould haue a ſuperfluity of bloode for the nouriſhment of the infant, as alſo that the partes of generation for want of heate to thruſt them foorth remaining within, might make a fit place wherein to conceiue, breede, and perfect the ſame. Why woman was made.

Againe, that there might bee a mutuall longing deſire betweene the ſexes to communicate one with another, and to conferre their ſtockes together for the propagation of mankinde, beſide the ardor and heate of the ſpirits conteyned in their ſeeds, the parts of generation are ſo formed, that there is not onely a naturall inſtinct of copulation, but an appetite and earneſt deſire thereunto, and therefore the obſcœne parts are compounded of particles of exquiſite ſenſe, that paſsion being added vnto the will, their embracements might be to better purpoſe. As for the particulars it ſhall be in vaine in this place to make mention of them, becauſe the following diſcourſe ſhall at large diſcipher them vnto you. In which we will firſt deſcribe the parts of generation belonging to men, and then proceede to thoſe of Women alſo; of which wee would aduiſe no man to take further knowledge then ſhall ſerue for his good inſtruction. And ſo we deſcend vnto our hiſtory. The nature of the obſcœn parts.

CHAP. I. *Of the Neceſsitie of the parts of Generation.*

IT is a ruled caſe in *Hippocratès* his Bookes *de dieta*, *Ariſtotle* in his Booke of the length and ſhortnes of Life, *Galen* in his firſt Booke *de ſanitate tuenda*, and at a word amongſt all Philoſophers & Phyſitians: That all things vnder the Moone which is (ſayth *Cicero* in *Scipio* his dreame) *vltima Cælo citima terris*, the laſt in the Heauen and the neareſt to the Earth; all thinges I ſay contayned within the Elements are ſubiect to corruption and diſſolution. For euery ſingular and particular thing either hath life or is without it: if it be without life it is obnoxious to diuers alterations, in regard both of the firſt and ſecond matter whereof it conſiſteth. For the firſt matter, it is alwayes in loue with new formes, and therefore moſt ſubiect to mutation, which the French Poet *Saluſt* expreſſeth vnder the compariſon of a notorious Strumpet, on this manner. Al Elementary things mortal, and how. *Saluſt.du Bart.*

Or like a Lais, whoſe vnconſtant loue
Doth euery day a thouſand times remoue:
Who's ſcarce vnfoulded from one youths imbraces,
Yet in her thought another ſhe imbraces:
And the new pleaſure of her wanton fire,
Stirs in her ſtill another new deſire.

The general matter of things like a ſtrumpet.

The ſecond matter which conſiſteth of the Elements, becauſe of their inteſtine diſcord (for they are contraries, and from contrariety comes all corruption) vrgeth continually the diſſolution of the mixed body.

The Elements themſelues whilſt they are out of their proper places, although they bee naturally linked together, yet it is not without a kinde of violence and conſtraint, and therfore doe inſtantly long to returne into their proper ſeates.

But if the body be animated and haue life, beſide thoſe already named, it hath alſo other cauſes of diſſolution bred with it; which no art, no induſtry of man can auoyde, no not ſo much as repreſſe: ſo all things which haue any kinde of life, eſpecially liuing and mouing creatures are deſtined to corruption, φύσει καὶ ἀνάγκη, that is, *by Nature & neceſsity*. By *Nature* becauſe of the exhauſtion or expence of the *Primigenie* moyſture by the Elementary heat and the continuall effluxion of the threefold ſubſtance. By *Neceſsity* becauſe of the permixtion of the Aliments and the increaſe of excrements, the ſuppreſsion whereof maketh an oppreſsion of the partes, ſtableth vp a fruitfull nurſery of diſeaſes, and finally induceth death it ſelfe. A double deſtiny. By Nat By Neceſsity.

Wherefore *Nature* whome *Hippocrates* calleth τὰ Κοῦλα ποιέουσαν *Recta facientem* and the ordinary power of God, being a diligent and carefull prouider for her ſelfe, hath giuen to euery thing a certaine appetite of eternity, which becauſe ſhee could not performe in the *Indiuiduum* or particular Creature, becauſe of the mortality of their Nature, ſhe indeuoured to accompliſh by propagation of formes and the *ſpecies* or kinds of things; as in the Elements by tranſmutation of one into another, in Minerals by appoſition, & in Creatures *Lib. Epidem.* The prouidence of Nature, or rather of the God of Nature. An image of immortality.

by

by Generation. For ſo euery *individuum* extending it ſelfe as it were, in the procreation of another like vnto it ſelfe, groweth young againe and becommeth after a ſort eternall. The father liueth in the ſonne, and dyeth not as long as his expreſſe and liuing Image ſtands vpon the earth.

The generation of perfect Creatures.

To paſſe by the production of other things, the generation of perfect creatures is accompliſhed when the male ſoweth his ſeede, and the female receyueth and conceyueth it. For this purpoſe Nature hath framed in both ſexes parts and places fit for generation; beſide an inſtinct of luſt or deſire, not inordinate ſuch as by ſinne is ſuper-induced in man, but natural reſiding in the exquiſite ſenſe of the obſcœne parts. For were it not that the God of Nature hath placed heerein ſo incredible a ſting or rage of pleaſure, as whereby wee are tranſported for a time as it were out of our ſelues, what man is there almoſt who hath anie ſenſe of his own diuine nature, that would defile himſelfe in ſuch impurities? what woman would admit the embracements of a man, remembring her nine moneths burthen, her painefull and dangerous deliuerance, her care, diſquiet and anxiety in the nurſing and education of the infant. But all theſe thinges are forgotten, and wee ouertaken with an extaſie, which *Hippocrates* calleth a little *Epilepſie* or falling ſickneſſe: and the holy Scripture veileth vnder the name of a ſenſeleſneſſe in *Lot*, who neyther perceiued when his daughters lay downe, nor when they roſe vp.

Natural pleaſure in generation.

Well, the Hiſtory of theſe parts of generation it is our taske in this Booke to deſcribe, ouer which alſo we could wiſh we were able to caſt a veile, which it ſhould bee impiety for any man to remooue, who came not with as chaſte a heart to reade as wee did to vvrite. Howſoeuer that which muſt needs be done, ſhall be done with as little offence as poſsible we may.

The parts therefore of Generation are of two ſorts, ſome belong to men, ſome to women. The parts of Generation belonging to men (for of the other we ſhall ſee afterwards) are verie many, but all conſpiring vnto one end, which is to exhibite ſomething out of themſelues which may haue the nature of a Principle; by which, and out of which a newe man may be generated. The Principle exhibited is ſeed, which becauſe it containeth in it ſelfe the forme and Idea of all the parts (for it falleth from them all) and beſide μοίρων περιγραμένην, that is, the fatal neceſsity of life and death; ſtoode in neede of manifold preparation, coction and elaboration, and therefore the ſtructure of the parts fit for ſo great and curious a worke is no doubt very exquiſite. For ſome of them do onely prepare the ſeede, or as it were rough hew it, as putting thereon a rudiment of ſeed, which before was nothing elſe but an ouerplus of the purer part of blood remaining after aſsimulation in the particular parts of the bodie.

The parts of generation in men.

This preparation is made in the ſpermaticall Veines and Arteries, whoſe admirable implications and complications like the wrethed or wormie tendrils of veines, do forme as it were a twiſted or bedded net, wherein the matter is ſo long retained, till it acquire ſome beginning of alteration from that it was before. Other parts there are which boyle it anew, as that we call *Epididymis* or *Paraſtatæ*, others affoord vnto it prolificall vertue, whereby it is enabled to produce and generate a thing like vnto it ſelfe, & thoſe are the teſticles which giue it the true forme of ſeede; others, when it is thus perfected, leade it downe toward the place of receipt which are called *Deferentia* or *Eiaculatoria vaſa*, albeit I ſee no great reaſon for the ſecond name, we call them the *Leading veſſels*. Others receiue, containe, and ſtore it vp for neceſſary vſe, as the many veſicles or bladderets, and thoſe Kernels or Glandules which are called *Proſtatæ* ſcituated at the necke of the bladder of vrine. Finallie, others deliuer it out, and ſtrew it in the ſeede plat, ſowe it in the fertile fielde of Nature the wombe of the woman, which is called *penis* the yard or virile member. Of all vvhich, if but one bee wanting, yea defectiue, the worke of generation goeth not at all or but lamely forward, wherefore we will endeuour to ſhew you the naturall both poſition, diſpoſition, and vſe of euerie one in their proper places.

CHAP. II. *Of the preparing ſpermaticke or ſeede veſſels.*

Two ſorts of ſeede veſſels.

THE firſt Inſtruments of Generation, are called *vaſa ſpermatica*, the ſpermaticke veſſels. Theſe are larger in men then in women, and they are of two ſortes, *Preparantia* or *Deferentia*, Preparing or Leading veſſels. The Preparing Veſſels [Tab.2.ſ.x a.Tab.fi1.g.1.° q r] which are called παρασκευάσικα by *Galen*, by *Auicen vaſa Lumbaria*, are foure. Two veines [Tab.1.° q.Tab.2.ſ.x] and two Arteries, on each

Preparing.

ſide

side one [table 1,[r], table 2,[z].] The right veine ariseth [Table 1,[o] table 2,[t]] a little below the originall of the emulgent [table 1,[h i] table 2,[m n]] from the vpper and forward part of the trunke of the hollow veine, as it were with a long and thick knub or knot [table 1,[p] tab. 2,[u]] (to which as *Galen* obserued, a certain small branch is conuayed from the emulgent) that it might afford more pure and better concocted blood. Veines. The right.

The left [table 1,[q] table 2,[x]] ariseth not from the trunke of the hollow veine, but from the lower part of the emulgent: for if it should haue risen from the same place in the hollow veine where the right seede-veine arose, it must necessarily haue gone ouer the great arterie [table 1,[g]] by the continuall motion of whose *systole* and *diastole*, that is, eleuation or distention, and depression or contraction, being smal, it would haue been either broken or much hindered from performance of his proper office, or else haue intercepted or offended the Arterie; both which inconueniences are auoyded by his arising, as we haue sayed out of the lower part of the left emulgent: [table 1.[t], Table 2,[u],] yet hath it sometimes a small braunch reached vnto it from the trunke [Table 2,[x]] of the hollow veine; the blood also it brings is more *serous* then that of the right spermaticall veine. The left. The great prouideuce of nature.

The two Arteries arise neare one another [table 1,[f] table 2,[a]] out of the middle trunke of the great arterie a good way beneath the emulgents, that they might bring thinner and better cleansed or defœcated blood. The right spermaticall Arterie climbing ouer [table 1, figure 1.[f]] the trunke of the hollow veine hastneth obliquely to the seede veine; the left closely accompanieth the veine of his owne side. And this Artery we haue seene sometimes absent, and then the left seede veine is so much the larger; otherwise, generally these arteries are larger then their veines; because it was necessary that many vitall spirites and Arteries.

Table 1. *Lib.* 4 *sheweth the Kidneyes with the Vessells of Vrine and of Seede; a part of the hollow veine, and also of the great Artery, the Testicles, the Bladder, and the Yarde.*

The first Figure sheweth the fore-side, the second the hinder-side.

TABVLA I.

FIG. II.

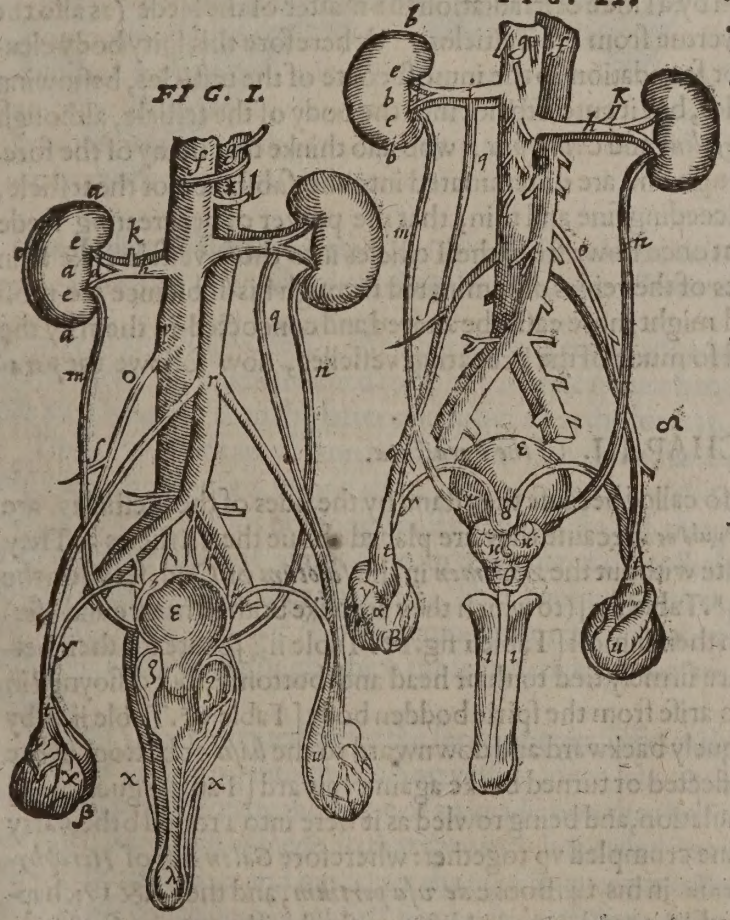


FIG. I.

aaa, 1. The fore part of the right kidney.
bbb, 2. The back-part of the lefte kidney.
c, 1. The outward side.
dd, 1 2, The inner side.
ee 1, 2, The two cauities whereinto the emulgent vessels are inserted.
ff, 1, 2, The trunk of the hollow veine.
gg 1, 2, The trunke of the great artery.
hi, 1 2, The emulgent veine and artery.
kk 1 2, The right fatty veine.
li, The left fatty veine.
* 1. The *Cœliacal* arterie.
mn 1, 2. The vreters.
opq, 1, 2. The right spermatick vein which ariseth neare *p*, the left neare *q*.
r 1, The place where the arteries of the seed do arise.
ſ 1, 2, Small branches distributed from the spermatical veines to the *Peritonæum*.
t 1, 2, The spirie bodden body called *varicosum vas piramidale*.
u 1, 2. The *Paraſtatæ* or *Epididymis*.
x 1, The testicle couered yet in his coate.
y 1, 2, The place where the leading vessell called *vas deferens* doth arise.
α 1, 2, The descent of the same leading vessell,
β 1, 2. The reuolution of the same leading vessel.
γ 1, 2. The passage of the same vessel reflected like a Recurrent nerue.
δ 2. The meeting of the same leading vessels.
ε 1, 2. The Bladder of vrine; the first figure sheweth it open, the second sheweth the back-part of it.
ζζ 1. The smal bladders of seed opened.
ηη 2. The glandules called *glandulæ prostatæ*. *θ* 2. The sphincter muscle of the bladder. *ιι*, 1, 2. The two bodies which make the substance of the yarde. *κκ*, 1. The vessells which goe vnto the yarde and the necke of the bladder. *λ*, 1. The passage which is common to the vrine and the seed, cut open. ⸸ The implantation of the vreters into the bladder.

much

A great cauſe of barrennes.

much arteriall bloud ſhould be conuayed to the Teſticle, that when the ſeede is perfected, it might be fulfilled with ſpirit and vitall heate. It is obſerued alſo, but more rarely, that in ſome bodies both the Arteries are wanting; and happely it falleth out ſo in them that are barren, becauſe there is no ſourſe of vitall ſpirits falling vpon the teſticles.

The courſe of the Spermatick veſſels.

All theſe veſſels, the right veine with his Artery, and the left with his, not much parted one from another [Tab.3.fig.2 θ θ] do beare vpon the *Peritonæum*, and proceeding downward, are ioyned together with fibrous ties, [Tab.3.fig.3 ΝΝ] and ſo paſſe along obliquely aboue the Vreters [Tab.1. fig:1, m n. Table 2 qq] allowing by the way certaine ſmall braunches [Tab:1.f. Table ii, β] to the *peritonæum*, thorough whoſe productions (which firmely grow to their ſides [Table ii, γ. Table iii, λ] at the groin) they make way, together with a ſmall nerue of the ſixt paire, and the Cremaſter Muſcle [Tab:2, ↓] and ſo fal to the *Paraſtatæ* [Tab: 1, u. Table ii, ε] and to the vpper part of the Teſticle, where the Veine and the Artery mixing together, do faſhion out betweene them one body like a *pyramis* [Tab. ii, from δ to ε] or ſpire depreſſed and plaine on each ſide. This bodie, becauſe of the innumerable branches of Veines and Arteries ioyned by *Anaſtomoſis* or inoculation, of which it is wouen as it were into a platted web, is called in Greeke κυρτοειδὴς παραστάλης by *Galen* in his book *de Semine*, in Latine *Corpus varicoſum* [Tab.1 t. Table ii, δ. Tab:3, Fig.ii, μ, fig.3. C. ſheweth the beginning of it, and P the *baſis* or foundation] the bodden bodye, and from the faſhion of the tendrils of Vrine *pampine-forme*, we may call it the *ſpiry bodden or emboſſed body*, to diſtinguiſh it from the *Paraſtatæ*, which are alſo called *corpora varicoſa* or bodden bodies. [tab 1. u Table ii, ε]

The ſpirie bodden bodie.

The vſe of the Spermaticke veſſels.

The vſe of theſe veſſels is not onely to leade downe blood of both ſorts, Veinall and Arteriall, together with vitall ſpirits for the nouriſhment and life of the Teſticles, but alſo to receiue a matter or ſubſtance which falleth from al parts of the body; (the laſt and moſt perfect ſuperfluity of the Aliment) ſome-what to alter it, and ſo to conuey it to the *paraſtatæ* for the generation of ſeede.

Veſalius. *Columbus.*

Moreouer about the middeſt of theſe veſſels, the blood hath his firſt beginning of *dealbation* or whitening, yea, and a farther preparation alſo in thoſe textures and webbes of which we lately ſpake, wherein by a kinde of irradiation the matter of the ſeede (as alſo the textures themſelues) receyue vertue from the Teſticles. Wherefore this ſpiry body cleaueth, yea groweth at his *baſis* or foundation to the inmoſt coate of the teſticles, beſtowing vpon them certaine ſmall ſurcles, but it entereth not into the body of the teſticle, although ſome woulde haueit ſo, as *Veſalius* and *Columbus*, who alſo thinke that many of the forenamed branches do paſſe through, and are diſſeminated into the ſubſtance of the teſticle, where their coates become exceeding fine and thin, that the power of procreating ſeede might the more ſuddenly and at once flowe from the Teſticles into thoſe veſſels; like as in the Liuer the tunicles or coates of the veines diſſeminated through his ſubſtance are moſt fine and ſubtile, that the blood might more eaſily be altered and concocted in them by the force of the *parenchyma*. And ſo much of the Preparing veſſelles, now followe the *paraſtatæ*.

CHAP. III. *Of the Paraſtatæ.*

Their ſeituation.

THE *Paraſtatæ*, ſo called becauſe they ſtand by the ſides of the Teſticles, are alſo called ἐπιδιδυμίδης, becauſe they are placed aboue the Teſticles. They are bodies ſcituate without the *Abdomen* in the *ſcrotum* or Cod, ſet vpon the Teſticles [Tab.1 u. Table ii, ε] (to which they are alike both in nature and vſe,) as yet wrapped in their inmoſt [Table 1 fig.1. x. Table ii, ζ] coate for their better ſafegard and defence, and are firmely tied to their head and bottome, but diſioyned in the middle. Theſe *paraſtatæ* do ariſe from the ſpirie bodden body [Table 1, r. Table ii, η] by continuation, and creepe obliquely backward and downward to the *baſis* or bottom of the teſticle, and from thence are reflected or turned backe againe vpward [Tab. 1. figu. ii, γ ω β] but without connexion or copulation, and being rowled as it were into a round orbe, carry the forme of the tendrill of a vine crumpled vp together: wherefore *Galen* out of *Herophylus*, calleth them κυρτοειδεῖς παραστάλας in his 14. Booke *de vſu partium*, and the 11. & 12. chapters. For they are white, long, thicke, and rounde, diſtinguiſhed with certaine ſurfles or conuolutions like a wood-worm, and by degrees become narrower, determining on both ſides into the *Vas deferens* or Leading veſſell which is like a round ſinnew. Some there be as *Veſalius* and *Platerus*, who would rather haue them to be the beginning of theſe *vaſa deferentia*

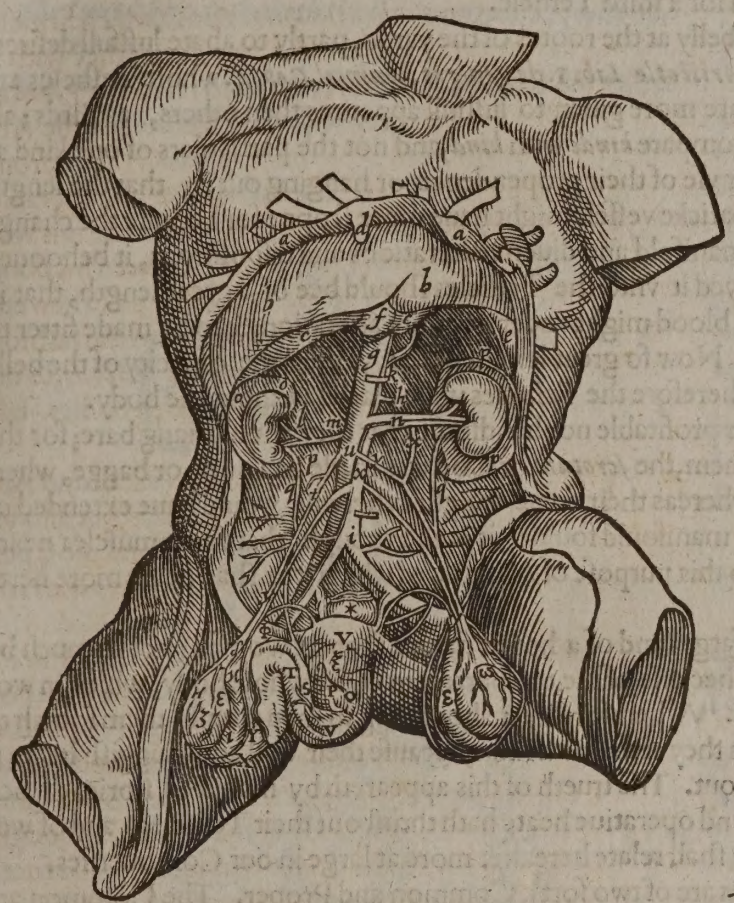
Their originall.

Galen.

Their forme.

Table 2. ſheweth the lower Belly with the Share-bones parted, that the veſſelles which ſerue for generation might the more plainly appeare.

TABVLA II.



a a A part of the midriffe and of the *Peritonæum* with the ribs broken.
b b c c The Conuex or gibbous part of the Liuer marked with *b b*. the hollowe or concauous part with *c c*.
d e The right and left ligaments of the Liuer.
f The trunk of the gate veine cut off.
g The trunke of the hollow veine.
h l The fatty veines both left and right.
i The aſcent of the great artery aboue the hollow veine, & the diuiſion thereof.
k The *Cæliacall* artery.
m n The emulgent veſſels.
o o p p The fat tunicles or coates torne from both the kidneyes.
q q The vreters that goe vnto the bladder.
t u The right ſpermatical veine which ariſeth neare to *u*.
x y The double original of the left ſpermaticall veine *x* from the emulgent, *y* from the hollow veine.
α The originall of the ſpermaticall arteries.
β Certaine branches from the ſpermaticke arteries which run vnto the *Peritonæum*.
γ The paſſage of the ſpermaticall veſſelles through the productions of the *Peritonæum*, which muſt bee obſerued by ſuch as vſe to cut for the Rupture.
δ The ſpirie bodden bodies entrance into the teſticle, it is called *Corpus varicoſum piramidale*.
ε The *Paraſtatæ*.
ζ The ſtone or teſticle couered with his inmoſt coate.
η The deſcent of the leading veſſel called *Vas deferens*.
θ V The Bladder.
* The right gut.
ξ The glandules called *Proſtatæ* into which the leading veſſels are inſerted. *ρ* The muſcle of the bladder. *στυ* Two bodies of the yard *ς* and *τ* and *υ* his veſſels. *φχ* The coate of the Teſticle. *ψω* The muſcle of the Teſticle *ψ*. his veſſels *ω*.

ferentia or Leading veſſels. And becauſe their ſubſtance is a little more ſolid then that of the Teſticles, they are eſteemed to be of a middle nature betweene the veſſels and the teſticles, that is harder then the latter, and ſofter then the former. *The ſubſtance.*

Theſe *Paraſtatæ* are alſo on their outſide membranous and neruous, and where they are without conuolutions ſmooth they are and euen, but within glandulous, and if they be cut they appeare fongous or ſpongy as if they conſiſted of many ſmall glandules. But when they are ſeparated and remoued from the coate of the teſticle, as they may eaſily bee with a ſharpe knife, then are they vnequall. They haue no pores or paſſages to bee ſeen in them; yet there bee that thinke (*Veſalius* among the reſt) that they haue ſmall pipes continuated with the Teſticles, through which the ſpermaticke power ariueth vnto them out of the Teſticles. *Veſalius.*

Their vſe is either to hinder the ſeede not yet ſufficiently laboured from falling downe out of the preparing into the leading veſſels, or to labour the prepared ſeede to a further degree of perfection by the helpe of an irradiation they haue from the teſticles. For they are often found full of ſeede, ſo that they may bee called not amiſſe, little ſtones. Againe, they ſerue to temper and moderate the ouer frequent motion of inordinate concupiſence, as *Ariſtotle* conceiueth in his firſt Booke *de generatione Animal. Cap. 4.* *The vſe of the Paraſtatæ.*

CHAP.

CHAP. IIII. *Of the Teſticles or Stones.*

Their names.

THE Stones are called *Teſtes* becauſe they are witneſſes of *virilitie*, in Greek ὄρχεις, ἀπὸ τῶ ὀργᾶν χεῖν becauſe in wanton Daliance the ſeede powreth it ſelfe forth, and διδυμοι, that is Twinnes, becauſe moſt what they are two for more fruitfulneſſe, but rarely one which yet *Archangelus* found, & very rarely three vnleſſe happely ſayth *Ariſtotle Lib.* 1. *Hiſtoria Animal. Cap*, 13. a little knot or knub in the Cod be miſtaken for a third Teſticle.

Archangelus. Ariſtotle.

They hang out vnder the belly at the rootes of the yarde, partly to abate luſtfull deſires: For thoſe Creatures ſayeth *Ariſtotle Lib.* 1. *de generat. Animal. Cap.* 4. whoſe Teſticles are hidden within the *abdomen* are more giuen to luſtfull appetites then others, as Birds; alwayes remembred that you compare *kinde* with *kind*, and not the particulars of one kind among themſelues. Another vſe of their propendence or hanging out is, that the length and reuolutions of the ſpermaticke veſſels might haue more ſcope: for becauſe the change of blood into ſeede needed manifold and diuerſe alterations and diſpoſitions, it behooued that the veſſels which conueyed it vnto the Teſticles ſhould bee of a great length, that in the length of this paſſage the blood might vnder go more alteration, & ſo be made fitter to receiue the forme of ſeede. Now ſo great length of the veſſels the capacity of the belly could not fitly receiue; and therefore the Teſticles were placed without the body.

What creatures are moſt luſtful. Why the teſticles hang out of the body.

The Cod.

And becauſe it was neither profitable nor handſome that they ſhould hang bare; for the receiuing and cloathing of them, the *ſcrotum* or Cod was made as a purſe or bagge, wherby alſo they are borne vp, whereas their owne waight otherwiſe would haue extended or drawne out into length their manifould foulds; it is alſo thought that ſome muſcles neare hand doe adde ſome helpe to this purpoſe of Nature, of which wee ſhall heare more hereafter.

Heat thruſteth the teſticles out of the body.

The Teſticles in men are larger and of a hotter nature then in women; not ſo much by reaſon of their ſcituation, as becauſe of the temperament of the whole body, which in women is colder, in men hotter. Wherefore heat abounding in men thruſts them foorth of the body, whereas in women they remaine within, becauſe their dull and ſluggiſh heate is not ſufficient to thruſt them out. The trueth of this appeareth by manifold ſtories of ſuch women, whoſe more actiue and operatiue heate hath thruſt out their Teſticles, and of women made them men: as we ſhall relate hereafter more at large in our Contouerſies.

The coats of the teſticles.

The coates of the Teſticles are of two ſorts, Common and Proper. The Common are two; which wee call Common, not onely becauſe they are Common to all the parts of the body, but alſo becauſe they inueſt theſe two Teſticles together. The proper coats are alſo two. Thus we will determine of them, albeit we know what great difference there is in Authors concerning the number of theſe coates. *Galen* nameth three in his Booke *de diſſectione vteri*, ὑσχεον δαρτὸν καὶ ἐλυτροειδῆ. *Veſalius* reckons foure, *Falopius* ſomtime three ſomtimes foure; *Columbus* three proper coates; *Archangelus* cals them three ſortes of membranes: one ſort common to the Teſticles with all the partes of the body, which is called *ſcrotum*; another ſort common to the Teſticles with the ſeminarie veſſels, which are two; one ariſing from the tendons of the muſcles, another from the production of the *Peritonæum*; a third ſort proper onely to the Teſticles: but we will proceed in our determination.

Diuers authors opinions.

The firſt common coate.

The firſt Common coate [table 17. *lib.* 3. *f*] is called ὑσχεον, as it were a purſe, and in Latine *ſcrotum* or *ſcortum*, becauſe it is like to a leather ſachell, for the Auntients called thoſe thinges *ſcortea* which were made of tanned leather or skinnes; and therefore the leather money which in thoſe dayes was in vſe, was called *nummi ſcortei*. This coate is ſoft and *rugous*, and is diuided as it were with a ſeame, which *Pollux* calleth *Perinæum*, made of the cuticle and the true skinne [table 17. lib, 3. *r*] but thinner then the reſt of the partes, and hath no fat about it that it may eaſily ſtreatch when the Teſticles ſwell with ſeede, or be corrugated and grow thicke, to ſerue in ſteade of many membranes: *Archangelus* addeth toward the compoſition of this *ſcrotum*, the fleſhy membrane falling from the ſhare-bones. For although it haue membranes, and thoſe wouen or chequered with many veſſels which are eſpecially neceſſary for the generation of fat; yet hath it no fat at all, for that there remayneth no oyly ſubſtance that might congeale into fat, becauſe all the ouerplus when the teſticles are nouriſhed is changed into ſeede.

Whereof made.

Scrotum or the Cod.

Why it hath no fat about it.

The ſecond common coat

The ſecond Common coate called δαρτὸς, becauſe it may eaſily bee ſeparated from the reſt, is produced from the fleſhy membrane [tab. 17. lib 3. *r*] where it is much thinner then

in

in other parts, and repleniſhed with Veines and Arteries: with both theſe coates are the Teſticles inueſted and ſuſpended, that they might not be iniured either with heate or cold, and ſo become vnfruitfull and barren. Alſo when the yarde is flaccid or looſe they hang

¶ *The firſt Figure ſheweth the diſport of Nature in the ſeminary veſſels, the emulgents, and the poſition of the left Kidney, as wee met with it in a publicke Diſſection.*

The ſecond Figure ſheweth the ſeminary veſſels, with the Teſticles.

The third Figure ſheweth the diuers formes of the Teſticles, and their ſeuerall parts.

TABVLA III.

FIG. I.

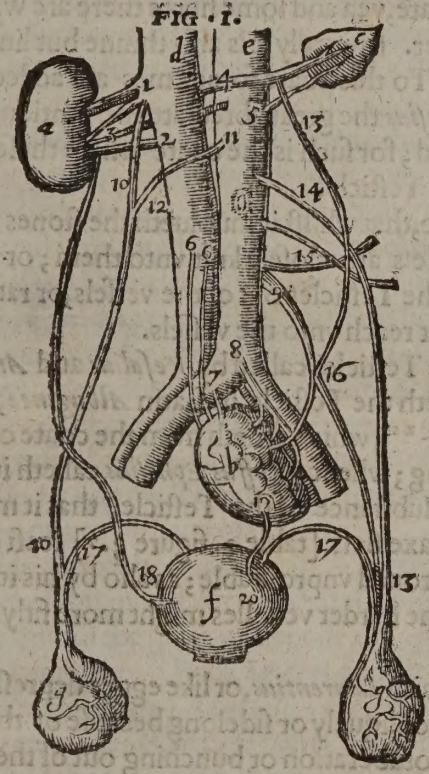
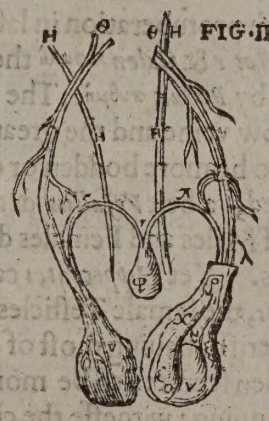


FIG. III.

FIG. II.



a b. The right Kidney *a*, the left *b*.
c A glandulous and fattie ſubſtance, which was in the roome of the left Kidney.
d e. The hollow vein *d*, the great artery *e*.
f The bladder of vrine.
g g. the teſticles.
1, 2. A double right emulgent veine, the firſt of which hath a double originall.
3, The right emulgent artery.
4, the left emulgent veine.
5, The left emulgent artery.
6, 6, two emulgent veines at the left kidney.
7, 8, The emulgent arteries vnder the biſurcation or diuiſion at the left kidney.
9, The fourth left emulgent veine.
10, 10, The right ſpermaticke veine.
11, 12, the original of the ſpermatick artery 11, his coniunction with the veine 12.
13 The left ſpermaticke veine.
14 the left ſpermaticke artery.
15 A veine going from the left ſpermatick vein to the *Peritonæum*, accompanied with an artery.
16 the vnion of the left ſpermaticke veine with the emulgent veine.
17 the leading veſſels.
18 The inſertion of the right Vreter.
19, 20. The original of the left Vreter at 19. and his implantation at 20.

Figure II.

nnnn the *Vreters*.
θθ The ſpermaticke veines and arteries.
ιι The coate of the teſticle which ariſeth from the *Peritonæum*.
χ The ſpermaticall vein and artery, as they paſſe into the production of the *Peritonæum*, and as they paſſe againe out of it.
μ The bodden bodie called *Corpus varicoſum*, or the wonderfull implication of the veyne and artery.
ν the left teſticle couered with the inmoſt coate.
ξξ The reuolution of the leading veſſels.
οp The aſcent of the leading veſſell vnto the ſhare bone.
σς the reflection or returning of the leading veſſels, to the backe ſide of the ſhare bones.
τφ the coition or meeting together, and inſertion of thoſe veſſels into the Glandules called *Proſtatæ*, at *φ*.

Figure III.

A, B. the forepart of the righe teſticle.
C C, D. the ſpermaticke veine and artery cut off where they fall out of the *Peritonæum*, and C ſheweth the beginning of the bodden body, called *Corpus varicoſum*, and D ſheweth his *baſis* or foundation. E the paſſage of the leading veſſell. F His reflection. G, a portion of the leading veſſell climbing vpward, with his departure from the teſticle. H, the porous or ſpongie face of the leading veſſel of *Epididymus*, where it groweth to the coate of the teſticle. I, the gibbous or round part of the ſame veſſell, where it groweth not vnto the foreſaide coate. L the forepart of the teſticle. M. the backe part of the ſame together with his inmoſt coate, and the bodden body. NN, the firſt commixtion of the ſpermaticke veſſels. OO, the *baſis* of the ſpiry bodden bodie, and his inſertion into the inmoſt coat of the teſticle. P, the teſticle couered with his inmoſt coate, ſhewing the vpper part into which the bodden or varicous body was inſerted. Q R S, the inmoſt coate of the teſticle, drawne from the teſticle at R. but couering the teſticle at S. *T*, the teſticle cut through the middeſt. V V. the diſtribution of the veſſelles through his ſubſtance.

Why the corrugation of the Cod is a signe of strength.

downe, but when that rises or is distended then the skin being also contracted and corrugated and with the yarde drawne vp, the Testicles also are suspended and drawne vpward; which ordinarily is obserued as a token of strength in young Children, who are often suddenly diseased; but if their Testicles be thus gathered vpward, it is commonly and not without reason, hoped that their naturall strength remaineth vndecayed; whatsoeuer the present cause or violence of the disease may be.

Their proper coates. The first and vtter.

The proper coates which doe inuest each of the Testicles by it selfe are two, yet (*Columbus* maketh three proper, and reprehends *Vesalius* for making but two.(The first and vtter is called ἐλευτροειδὴς, that is, *vaginalis*, as it were the sheath or huskie membrane [Table 17. lib. 3. [u] where it appeareth whole; table 3. figure 2. [rr]. tab. 2. at ♀ χ ♄ cut open] for so saith *Pliny*, Prouident Nature hath inclosed all the principall bowels, *membranis propriis ac veluti vaginis*, that is, In proper membranes, as it were corne in the huskes. It is also called by *Paulus* from the fashion it carrieth ἑλικοειδὴς, or *Capreolaris*, that is the Tendrill. It ariseth from the production of the *Peritonæum*; it is thinne and strong, and outwardly groweth to the δαρτὸν, fastned with a multitude of membranous fibres [Table 17. lib. 3. from [u] to [t],] which *Columbus* thought to be a particular coate, yea and some fibres there are which ioyn the husky coates of both the Testicles together. Inwardly it is also thinne but lined with a watery humour and aboundeth with veines. To this coate sometimes are added certaine small fleshy fibres (whence it is called by *Oribasius* the great abreuiater of Antiquity ἐρυθροειδὴς from ἐρυθριάω, which signifieth to grow red; for such is the coate where these fleshy fibres are) which goe vnto the bottome of the Testicle.

Paulus. *Columbus.* *Oribasius.*

The vse of the vtter coate.

The Vse of this Membrane is thought to be, that whilst it inuolueth the stones as it were within a huske or sheath, the spermaticke vessels are closely knit vnto them; or that there might be an infusion of imperfect seede into the Testicles out of the vessels, or rather, that from the Testicles some force or faculty might reach vnto the vessels.

The second & inner coate of the testicles.

The second or inner proper coate of the Testicles called by *Vesalius* and *Archangelus* ἐπιδίδυμις, because it immediately encompasseth the Testicle, in Latin *Albuginea*, the white coate [Table 2. ζ table 3. figure 2. [u] figure 3. [q r s]] which ariseth from the coate of the spermaticke vessels is white, thicke, and very strong; whence *Ruffus Ephesius* calleth it ὑμὴν ευρράδη, πρόσφυσις. It immediately inuolueth the substance of the Testicle, that it may firme, stay, and as it were knit together his soft and laxe flesh [table 3. figure 3. τ] least otherwise it should haue beene too loose, and so haue proued vnprofitable; as also by his interposition as it were of a meane or middle nature, the harder vessells might more fitly grow and apply to the softer substance of the testicle.

Their figure.

The Testicles are round of an ouall figure saith *Laurentius*, or like egges depressed or flatted somewhat on either side; and they hang obliquely or sidelong because of the vessells which grow vnto them, and because of the protuberation or bunching out of the *Parastatæ* as if they were two small stones; which protuberation in lasciuious men is not vnusuall. The vpper bunching part is called by *Aristotle* & *Galen* κεφαλὴ the head, the lower which is blunter and larger is called the bottome; by *Pollux* πυθμὴν. The right is the hotter because of his vessels which transfer from the hollow veine and the great arterie more pure and sprightfull blood vnto it: it is thought also to be more bodden or embossed, and the seede on that side is thought to be better concocted, albeit *Vesalius* denyeth any difference, who doeth not conceiue that the procreation of Males and Females dependeth vppon the greater or lesser implication of these substances. Yet *Hippocrates* calleth the right ἀρρενόγονος, that is, the Male Testicle, and the lef θυλυγονος, the female Testicles which is fuller of seede then the other, but that more weake and watterish, hauing most of his matter from the emulgent; whence it is that the Nature of women seemeth to be more intent vppon generation then that of man, euen from the very beginning: witnesse the childish disports of young Girles in making of Babies, Nursing, and lying in, as we say, and such like pastimes, wherein they are occupied euen from their infancy.

A note of lasciuious men. *Aristotle.* *Galen.* *Pollux.* The right hotter. 6. *Epid sect.* 4. The reason of young Girles disports.

These Testicles being ioyned by the interuening of membranes, do hang down from the sharebones and the yarde.

Their substance.

The substance of the Testicles is glandulous, white, milky, soft, laxe or loose in men and spongious, because of many smal veines [table 3 fig. 3. [u u]] dispersed through their bodies, but yet there appeareth no cauity or hollownes in them.

Musles.

They haue on each side one muscle and that a long one [table 2. Ψ table 3 figure 2. χ] and slender, beginning at the hanch bone, or rather from a strong ligament which runneth from

from the hanch to the share-bone in that place where the transuerse muscles of the lower belly doe end, of which these muscles seeme to be a part, and they get out by the out-let of the Tendons of the oblique muscles, and outward neere the leskes they grow to the vessels which attaine vnto the Testicles and vnto the heades of the Testicles themselues. Sometimes from the forepart of the share-bone there are certaine fleshy fibres communicated vnto them, so that they may be obserued to haue (as they haue alwayes in Apes) a double originall. The connexion and originall of these muscles.

By the benefite of these muscles, the Testicles which are pendant, are suspended or hung (whence they are called κρεμαστῆρες) that they should not bee a burthen to the spermatick or seed vessels as we touched before. Moreouer in copulation or coition they draw them back, that the seed-trough becomming shorter, the seed may more easily and readily be supplyed. And *Galen* in his fourth booke *de vsu partium* and the 14. Chapter sayeth that they partake of voluntary motion. *Cremasteres.* Their vse.

For their nourishment and life the Testicles receiue matter from the spermaticke [table 2 ω] veines and arteries. How then may some say are they nourished with bloud? I answere, as the Paps are nourished with Milke; for their bloud is not red but turned into Milke and Seed, as also the bones are nourished with marrow. For all the parts of the body are nourished with bloud, either red or turned into a substance more conueniēt for the part which it is to nourish. A reasonable nerue also they haue, from the rib branch [tab. 6. lib. 2. fig. 1. iii] of the sixt paire; sometimes also two other nerues ariue vnto them from the 21. coniugation of the marrow of the loynes (that hanging out of the body they might not yet bee depriued of exquisite sence) which after being ioyned to the spermaticall vessels are carried downward, and implanted into the coates of the Testicles. Their vessels by which they liue.

The vse of the Testicles is (for that without them neither can seede be ingendered nor any absolute Creature perfectly generated) by their inbred faculty to giue to the seede not so much the colour (for it falleth not into the substance of the Testicles as *Vesalius* and *Laurentius* do suppose it doth) as the very form & generating power, and that so strong and vigorous, that a perfect and absolute Creature out of it may bee generated; which power in men is the cause of *virilitie*, and in a woman of woman-hood or *muliebritie*. Moreouer by reason of this faculty the Testicles are esteemed the prime instruments of generation, and also by some, principall parts of the body. The vse of the Testicles.

They adde also to the body much strength and heate as appeareth by Eunuches, whose temperament, substance, habit and dispositions are all altered, as wee shall heare hereafter, and that because of the great consent of the vpper parts with these Testicles mentioned by *Hippocrates* in his second Book *Epidem.* and the first section, in these words. *When the Testicles doe swell vpon a Cough, it putteth vs in mind of a sympathy and consent there is between the Chest, the Paps, the Seede, and the voice.* And how great the consent is betwixt the parts of respiration and the parts of generation, he sheweth in the fourth Book *Epidem.* and the last Aphorisme saue one on this manner. *They are troubled with a dry Cough whose Testicles doe swell, and that Cough endeth in the tumor of the Testicle if a veine be opened; and when the Testicles are inflamed men do Cough much.* And again, *Those that are agueish with tumors in their leske, haue Coughs follow them continually.* Their consent with other parts. Of their consent with the chest.

For the consent of the Testicles with the head, I can giue you a notable instance of a wanton young fellow, who vpon a small and almost insensible tumor (especially at sometimes) in or about one of his Testicles, fell first into light, and after into extreame fittes of the Epilepsie or Falling sickneese, whose name I suppresse, not for his desert toward them that deserued well of him, but for the reuerence of our Art. The head. A story worthy the obseruation.

Finally, in excellency the Testicles are like vnto the heart; for that Cordiall *Epithymations* applyed to the Testicles in great languishments of the spirits doe little lesse auaile, then if they were applyed to the heart it selfe. The heart.

CHAP. V. *Of the vessels called Vasa deferentia, or Leading vessels.*

THE Vessels which Leade the seede called *vasa deferentia* [Table 3. figure 3. iii separated from the Testicles] are called by *Herophilus* πόροι σπερματικοί, by *Falopius*, *Canalis seminarius*, the seede-cane.

They are scituate partly without the *Abdomen* in the *scrotum* or Cod, partly within the cauitie or den of the Hip-bones on either side one, at the head Their scituation,

of the teſticle, and are produced from the *Paraſtatæ*, to which they are continuated, [Tab. 1 fig. 1, γ, σ, ζ] as alſo are the preparing veſſels, [Tab. 1. fig. 1. ϝ] although their names bee diuers according to their diſtinct offices and ſcituations.

Their ſubſtãce

Their ſubſtance is neruous and crumpled or writhen, [Table 2 κ the deſcent of the Leading veſſells, from ι to ρ the reflection or turning of it; and Table 1. figure 2 γ is the original of this veſſell, his deſcent at α, his reuolution at β. Table 3. Figure 3. from ϝ to ϝ downward] contorted at the lower end of the teſticle; but where they are parted from the Teſticles, they are round and white, and their cauity or hollowneſſe is but obſcure [Table. 3. fig. 3 κ ſheweth the porous ſurface of the leading veſſell, where it groweth to the couering of the teſticle] neyther needed it to bee more open, becauſe the ſeede by reaſon of his aboundance of ſpirites wherewith it riſeth and houeth or worketh vppe, can eaſilie paſſe thorough.

Connexion.

Progreſſe.

They ariſe vpward [Table 3. fig. 3, ϛ] and are tyed to the preparing veſſelles [Table 2. at ſ ε] by the mediation of a thinne and ſmall Membrane, preſently after (by the ſame way by which the preparers deſcended) they are carried through the productions of the *Peritonæum* [Table 2. at ο. Tab. 3. fig. 2 ο ϱ] to the Share-bone, at which place the bone hath a ſuperficiarie cauity [Table, 26, lib. 3. figure 12, 13, ψ] which giueth way vnto the roundneſſe of theſe veſſels. After being returned downward [Table 1. Figure 1. from ψ to ζ, Tab. 3. Fig. 2. π ϱ] like Nerues, and tyed on the backe ſide (where the humour they containe is nowe become white) to the *Peritonæum*, they are led ouer the [Table 3. Figure 2, ν ν] Vreters, and vnder the backe ſide of the bladder aboue the right gut neere vnto the necke of the Bladder; a little before theyr vniting together [Table 1. Figure 2. ſ. and Table 3. figure 2, τ, is the vniting of the Leading veſſelles] they are on eyther ſide dilated and become thicker, where theſe ſmall Bladderets of ſeede [Table 2. Figure 1, ζ ζ] called *Veſiculæ Seminariæ*, are adioyned vnto theyr ſides, but the Leading Veſſelles themſelues are ſpent, the right into the right, the lefte into the lefte *Proſtate Glandule*. [Table 1. Figure 2. ν ν. Table 3, Figure 2, φ]

Vniting.

Their vſe.

The vſe of theſe Leading veſſelles, is to carrie or leade the ſeede after it is laboured in the Paraſtatæ, and made fruitefull and prolificall by the Teſticles, vnto thoſe Proſtate Glandules, as it were vnto certaine Magazines or Store-houſes, where the right Veſſelle meeteth and coupleth with the lefte, that the ſeede of each Teſticle might together and at once bee thither conueyed, and ſo ſnot together into the Womb by the Virile Member.

Moreouer, their oblique paſſage furthereth much the ſeedes perfection; for as in making of Aqua-vitæ or ſuch like ſtrong ſpirits of wine, wee ſee the liquor firſt aſcendeth and then deſcendeth, ſo the ſeede being to become a frothy body, was of neceſsity to bee perfected by ſuch ſublimation and precipitation.

CHAP. VI. *Of the Bladders of ſeede.*

What the bladders of ſeede are.

THE ſmall bladders of ſeede [Table 1, fig. 1, ζ ζ ſhew them open] are placed betweene the Ligaments of the Bladder of vrine & the right gut at the ſides of the leading veſſels a little before they become thicke and are vnited. They are compounded (ſaith the Author of the Definitions) of a veine & an Artery mixed together. They are on either ſide one, neruous, large and fayre enough to be ſeene, hauing not as other bladders one cauity, but are full of boughtes and turnings like burſt or knotted veines, implicated or folded one within another (and therefore *Herophylus* calleth them παραστάδας κυροειδεῖς, *Adſtites varicoſos*) ſo that they ſeeme to be many, and in them (ſaith *Fallopius*) ſeede may be kept many months. For Nature being deſirous of the continuance and perpetuitie of mankind ordained, that all times ſhould bee fit for their procreation, and therefore it was verie meete, that a matter rightly for that purpoſe diſpoſed, ſhould at all times be readily ſupplyed, but becauſe man coulde not alwayes entend that worke, and yet it was neceſſarie, that euen this excrement or ſurpluſage ſhould be auoyded, therefore like other excrements it alſo was to bee gathered together in ſome place, and there kept till a fit occaſion were offered, that from thence it might bee ſhot foorth.

Why created.

Varolius

And for this purpoſe (ſayth *Varolius*) theſe Bladderets were created, into which the ſeed ſhould bee continually emptied out of the Teſticles, and therein ſtored vp againſt the time of expence.

But

But leaſt ſo great a quantity remaining in one place ſhould corrupt, there are many turnings & windy boughts and paſſages in them, which alſo are a ſtay vnto the Seed, that in one Coition or accompanying of the ſexes, all the ſeede ſhould not bee ſpent. For, the ſeed winding it ſelfe out of thoſe manifold Labyrinths by degrees, doth paſſe away more ſafelie and moderately, and with better ſtay and deliberation. Their vſe.

But we ſaith *Bauhine* haue hitherto obſerued that theſe bladderets are full of a yellow oily humor wherewith the paſſage common to the ſeede and the vrine is illined or ſmeared leaſt it ſhould be hurt by the acrimony of either of them, or leaſt when it is drie it ſhoulde cloſe together, and ſo hinder the next euacuation. For to this end in copulation this oylineſſe together with the ſeede yſſueth ſenſibly and feelingly, at other times it welleth out inſenſibly; *Galen* addeth in the 14. Booke *de vſu partium* cap. 11. that it prouoketh luſt, and keepeth moyſt the necke of the bladder of vrine. *Bauhine.* *Galen.*

CHAP. VII. *Of the Proſtatæ.*

THE *Proſtatæ* as it were *fore-ſtanders*, are called by *Herophylus* πρόσθιαι ἀδενοειδεῖς. *Columbus* cals them *Paraſtatæ*. *Fallopius* calleth thē *aſsiſtant Glandules*. *Varolius* two Teſticles ſmaller then the other. *Veſalius* out of *Galen* calleth them σώματα ἀδενοειδῆ, that is, Glandulous bodies. And ſo indeede they are two Glandules [Tab. 1. fig. 2. *n n*] on either ſide one, placed in thé cauitie of the *Abdomen* at the lower part of the bladder [Tab. 2. *c*] that is in the neck aboue the ſphincter [Tab. 2. *e*. Tab. 1. fig. 2. *b*] Muſcle, or rather betwixt the necke of the bladder, and the lower Muſcles of the yard at his roote, where the Leading veſſels are vnited. [Ta. 1. fig. 2. *d*] Their names. Scituation.

Theſe Glandules are depreſſed before and behinde, but round on the ſides, into which as it were into other teſticles, the leading veſſels do end. Figure.

They are couered with the Membrane which did inueſt the leading veſſels, but now become ſomewhat thighter, leaſt the ſubſtance of theſe *Proſtatæ* being rare and ſpongie, the ſeede ſhould ſoake out of it owne accord through their open pores, albeit they be very narrow. Yet is this Membrane verie thin, and hath in it verie blinde breathing pores, which at the firſt ſight are not conſpicuous, but when the Glandules are preſſed, they appeare, for by them the ſeede may be ſcruzed in notable quantitie into the common paſſage, as it were by grains or like ſmal ſeeds, euen as we ſee Quick-ſiluer paſſeth through leather wherin it is faſt tied, if it be ſtrained, whence alſo in coition great pleaſure enſueth; the exquiſit ſenſe of the membrane being tickled in the paſſage with the gentle & pleaſing acrimony of the ſeed. Membrane. Compariſon. The tru cauſe of pleaſure.

Their ſubſtance is hard, ſpongie, and whiter then the reſt of the Glandules, they are alſo large, as containing in them ſo much ſeede (ſaith *Archangelus*) as wil ſerue for the procreation of foure or fiue infants; three or foure (ſaith *Columbus*) in thoſe that are fruitful. And therefore it is no wonder (though *Ariſtotle* writeth it for a wonder) that a Bul after his teſticles are cut off, may get a Calf. *Veſalius* hath obſerued that the proſtate glandules are notoriouſly large & ful in Monkies; and indeed they are of al creatures the moſt laſciuious, as we do not only read in authors, but haue alſo ſeene by the great Baboons which were heere to be ſeene among vs; for they would in a maner offer violence euen to a woman. It is therefore a very wicked and inhumane thing for Gentlewomen to cheriſh them in their boſoms yea in their beds, as I haue ſeene ſome doe with mine owne eies. Their ſubſtāce *Archangelus.* A Bull may get a Calfe when hee is caſtrated. A beaſtlie abuſe.

The vſe of theſe *proſtatæ* ſay ſome, is to ad ſomwhat to the generation of ſeed, & their reaſon is, becauſe there is no where found ſo great quantity of it as in them: but if this wer true then euen gelded creatures would engender ſeed, and ſeeke to auoid it, which *Galen* worthily gainſaieth. *Varolius* ſeemeth to countenance this conceit, who ſaith, that in the end of the leading veſſels there are placed two other ſmal teſticles, which giue vnto the ſeed his vttermoſt abſolution or perfection, the leading veſſelles miniſtring vnto them, as the preparing do to the Teſticles. A falſe vſe. *Galen.*

Their true vſe is to receiue from the leading veſſels the ſeed now ſufficiently laboured and made prolifical or fruitful, and to keepe it till the time of profuſion or ſpending as we ſay. It may be alſo they make it more thick, as adding the laſt hand vnto it, for it appeareth in theſe thick and white, in the teſticles but thin and ſerous: ſure it is, that the ſeed neuer procureth pleaſure till it come from them, witneſſe thoſe that are immoderate wantons, who ſpende themſelues ſo frequently, that there is no time for the ſeede to bee ſtored vp in theſe parts; their minds indeed are more then brutiſhly luſtfull, but their bodies are not ſo delighted as other more moderate men by their owne confeſsion. Their true vſe

How these glandules are pressed

These Glandules being pressed on their backe sides by the lower Muscles of the Yarde, [Tab.4.fig.1,and 2.$^{n\ l}$] which arise from the sphincter of the fundament,[Table 4,fig.1,^{M}] do constraine the seede into the common passage [Tab.4.fig.2,^{e}] which in the forepart of it they open. Into which their insertion can hardly bee discerned, but is opened when the seede flowes foorth.

A story out of *Vesalius.*

Vesalius telleth a tale of a fellow that was hanged at *Padua* in *Italy* who had the running of the reines, in whose body euen after his death all these passages were manifestly open and free, especially those of the leading vessels into the neck of the bladder. Moreouer with their solid and firme substance they support the necke of the bladder, that it should not faile or fall, that so those narrow passages, and for the most part insensible which attain vnto the end of the necke of the bladder, should bee kept streight, that the eiaculation of the seede might not be interrupted in the excretion, although the fall of this doe stay the yssue of the Vrine.

CHAP. VIII. *Of the yard or virile member.*

The names.

THE Yard is called in Latine *penis a pendẽdo* of hanging, and *Virga*; in Greek πουλὸς, and by an excellency μόριον, that is, *virile membrum*, the virile member, because of the fœcundity thereof. Many other names it hath both in Greeke and Latine, a Catalogue whereof *Laurentius* hath put downe vnnecessary for our turne, wherefore we haue spared our owne labour and your ears. The scituation is well knowne to be at the bottome of the lower venter on the outside [Tab.4.fig.1,2] as neere the fundament as it well might, and not be troublesom by falling vpon it in the time of seidge: Not aboue the groine, or in the *Hypogastrium* or watercourse, because there is no bone to establish his originall. It was therefore necessarie it should arise at the very roots of the share bones, as wel for the establishment thereof in the act of generation, as also that it might be more fit to meete with the womans lap, and yet no hinderance to the actions of other parts. And because it was not necessary there should be more of them then one, it is placed alone in the midst. Long it is, [tab.4.fig.1,2] round, but not exactly, for the vpper side of it, which they call the back, is somewhat broader, and endeth in a dudgen or blunt point. The length and thickneſse of it is diuerse, as well in respect of the kinde or species, as of the particular creature or *indiuiduum*. In respect of the kinde, it is of such a length and magnitude as the necessity of the kinde requireth for procreation: but in men shorter then in many other creatures, because men doe vse *aduersam non auersam venerem.* Of the *indiuiduum* or particular, because it is formed commonlie according to the proportion of the members, yet sometimes it is large in a little man, because of the aboundance of the portion of the fathers seede of which it is framed, for the seede falleth from euery part of a mans bodye, and carrieth in it power of generating that part from whence it fell. Although *Galen* in his sixt Booke *de locis affectis* towards the end, writeth, that continence makes it to encrease, at least in thicknes. It is thought also it wil be longer if the Nauill-strings [Table 4. fig. 7.$^{v\ v\ x}$] bee not close knit by the Midwife when the childe is new borne; and that because of a Ligament which commeth to the Nauill from the bottome [Tab.4 fig.7,^{x}] of the bladder which they call *Vrachos*, for the straighter that is tyed vnto the Nauell, the more the bladder and the partes adioyning are drawne vpward.

The reason of the scituation.

The Figure.

The dimensions.

The cause of the largenes of the yard. *Galen*

How to make it long.

The coats.

That part of the yard which hangeth out of the *Abdomen*, is couered with a cuticle and a skin not very thicke (which is laxe or loose when it hangs, but in erection is stretched) equall to his length, and knit vnto it at the lower part of the *glans* or nut, it is also couered with a fleshy membrane which heere becommeth neruous. There is no fat betweene the coates, least the member should grow by that meanes to great, and so his action be hindered, or to soft which would hinder erection.

The parts of it

It hath two parts, the one next to the belly which is the more principal, and hangeth not out, and it is called ὑπόσημα, which is below the commissure or ioyning of the share bones, to the middest of which it is fast knit in the *Perinæum*, (that is, the space betweene the cods and the fundament) with strong Ligaments and Muscles, and rising vpward vnder the testicles, appeareth round aboue the *scrotum* or cod.

The other part of the yard is called σῆμα, and hangeth downe without the body from the vpper part of the share-bone if it be flaccid, or if it grow strong and rigid, it is raised vpward and so stands commonly so farre from the body, as the necke of the wombe is in length inward

ward, that so it may yeeld seede vnto the very orifice of the wombe for the propagation of mankinde.

The structure of this member is such as is fittest for his vse and the necessity of Nature. It is not bony, as in a Dogge, a Woolfe and a Fox; for so it would not be a pleasure but a great troble to the other sexe; besides, being alwayes rigid or stiffe it woulde haue beene both vncomely and haue hindered many actions and postures or positions of the body. The structure. Why not a bone.

It is not gristly or *Cartilaginous*, for then it could neither haue beene distended (for a Cartilage hath no cauitie) neither could it haue beene soft and pliable. Gristle.

It is not of the Nature of a veine, for then it could not so soone haue beene filled and emptyed againe; as also for that the simple coate of a veine would not haue endured any strong streatching. Veine.

It is not of the nature of an Arterie although that haue a thicke and hard coate, because of the continuall pulsation, vpon which a man cannot lay a law when he pleaseth. Artery.

It is not neruous, because Nerues haue no manifest cauitie, neither are they naturally dilated; beside that, the softnes would haue hindered the tension or erection. Nerue.

It is not a Ligament, although that would haue been fit for tension or erection, because then it should haue had no cauity; and being beside without sence, it would not haue been capable of pleasure. Ligament.

It is not a Tendon, because they haue no cauity, and are beside softer then Ligaments, and so not so fit for erection. Tendon.

Much lesse could it well be made of flesh, or glandules, or muscles, or membranes.

It was therefore requisite that some other peculiar substance should be found out, such as was not elsewhere in the whole bodie, that should be hard and hollow, that without difficultie or inconuenience, might successiuely at conuenient times according to the presence or absence of the spirits bee raysed vp, or againe sinke or settle downe; and of so exquisite sence beside to breede that pleasure, whereby man is prouoked to rush into so obscoene a peece of buisinesse.

Of such sort and structure therefore there are two bodies [table 1, figure. 2. [ii], table 4. figure 1. 2.3.4.5.7.9. [A B]] which together with the Cannell or passage doe make the yarde. They are hard, neruous and like ligaments, on either side one, arising from the lower part of the share-bone [table 4. figure 2.3. C C] where it is thicke and round, & the vpper part of the *Coxendixe* or hanch, as well that hauing a substance partaking somewhat of a bone, the yarde might bee better disposed to rigiditie, as also hauing his originall for a stable body, it might bee kept stable and straight in the performance of his action to which it is by nature designed. How the yard is construed. The 2. bodies.

These bodies are on the outside round, on the inside plaine, and below at their original are diuided [table 4. figure 4. and 5. [E E] the two bodies, and [c] the canale or pipe] that they may yeeld way vnto the passage which commeth from the Bladder; by and by they are carried vpward, and about the middle of the share-bone they are ioyned together [tab. 4, fig. 4.5. [F]] yet so as they seeme to bee distinguished by a white Line running in the middest of them if the yarde bee cut ouerthwart. [table 4. figure 4.] From thence they are returned downward to the Nut [table 4. figure 4. 7.9. [D]] and doe inwardly end in an acute angle, and together with the canale or pipe doe fashion out the length of the yarde. Ouer those ends groweth the substance of the glans or nut, and so the whole figure doth in some sort represent the greeke ζ, which therefore ought to be obserued because of the vse of the Catheter in the suppression of the vrine. For if the Catheter be not insinuated or gently put in with a kind of dexterity, it either hurteth the pipe or the necke of the bladder so that bloud will follow, or else it will not passe into the cauity of the bladder. The Catheter

The substance of these bodies is excauated or hollowed like a pipe (from whence they are called the hollow nerues) but of a fungous or spongy matter [tab. 4. figure 4. 5. [E E]] and filled with blacke bloud: so that naturally it is blackish. A remarkeable obseruation for Chyrurgians, that in the section of a putride yarde, they doe not take that for rotten which indeede is but Naturall; the want of which knowledge I am perswaded hath cost many a man a good ioynt, which otherwise might well haue beene saued. It is also wouen like a Net made of innumerable braunches [Table 1. figure 1. xx, table 4. fig. 5. [b]] of veines and arteries diuersly intangled together, which are very notable vessels, and ariue here from the region of the great or holy-bone [tab. 8, lib. 3. [tt].] A good note for Chirurgions. The vessels of the yarde.

These bodies are also rare and porous, that they might suddenly bee filled with spirites and

The vse of the structure of his bodies.

and with venall and arteriall bloud when the yeoman is irritated or incensed; and his violence being appeased, the same spirts and blood being partly dissipated and partly returned into the vessels, settle and shorten again. For if the member were alwayes strong and stiffe it would be a great hinderance to men in many labours of this life, especially such as are violent, and beside it selfe would bee alwayes subiect to mischiefes, euen as the arme or hand would be if it were continually streatched forth. On the other side, if it were alwayes flaccid or loose, it would be vnprofitable for that imploiment for which God and Nature haue ordained it. Wherefore onely in the time of coition it ought to bee swolne and rigged or erected: swolne and extended to a iust magnitude that it might fill the neck of the matrix, *quo vtriusque pudenda incalescant*. For it is mutuall heate which calleth and prouoketh the seed out of the inner parts: Rigid and straight not onely *ad commodiorē coitum*, but also that the passage being open and direct, the seede might more freely and directly bee eiaculated or shot foorth from the very *Prostatæ* wherein it is contained. For if it were either oblique or crooked, (as it is in those which are called ὑποσπαδίαιοι in whome the passage is retorted by reason of a bridle at the end of the yarde, who therefore cannot procreate vnlesse that bridle be cut) or did in any place not stand open but fall together, then would the seed stay or make stop in the passage.

The coates of the yarde.

But againe, least the spirits which flow vnto it, and by which it is distended, should bee too soone dissipated or scattered through the fungous or spongy substance, it is couered and strengthned with membranous coates thight and very strong (which some men imagine doe arise from the commixtion of those vesselles which passe vnto the yarde,) which are therefore called the neruous bodies of the yarde, and they are also thicke and substantiall, that they might more easily be distended.

Comparison.

For when as in venerious appetites, the bloud & the spirits do in great quantity assemble themselues out of the veines and arteries, that member is as it were a gutte filled with winde, presently swelling and growing hard, which no question commeth to passe when as the sphincter muscle (which encompasseth the necke of the bladder, the roots of the bodies of which the yarde is made, and the ends of the guttes) is contracted and presseth out the spirits abounding in those parts, vnto the yarde; for so wee see the iugular or veines of the throate to be distended, when in laughter the chest is compressed and straightned. So also the veines of the arme by reason of the constriction of a Ligature or tye are distended and growe hard and full: so then it appeareth that voluntary motion is not onely requisite for erection, but also for induration.

The Pipe of the yarde. *Galen.*

The Pipe or Canale of the yarde [Table 4. figure 1.4.5.7.[G]] which in greeke they call σφίγγηρ, the vrinall pipe, or as *Galen* in his 15. Booke of the vse of parts and the 3. Chapter, the *spermaticke pore*, commeth from the bladder [table 1. fig. 1. λ from the bladder [c] table 4. figure 6.] whose necke is long. This Pipe scituated vnder the bodies of the yarde [table 4. figure 4. and 5.[G] vnder [E E]] is reflected together with them (in which reflection or returning if putride or rotten seede in a *Gonorrhæa* or running of the reynes, doe subsist or make stay, it there vlcerateth the passage) and becomming in the middle betweene them, it passeth along the length of the yarde vnto the outside of the Nutte, where it is embraced by those bodies ioyning together [table 4. figure 4.5.[F]] in narrow angles, and so maketh the whole yarde perforated as was necessary for the emission of seede.

How the seed putrifieth in a *Gonorrœa.*

The membranes of the pipe.

This Canale or Pipe hath two membranes (of which none almost of the Anatomistes make any menton, saue *Bauhine* onely, and *Archangelus* of the inner) one inward and thinne wherewith also the nut or glans is couered, bred out of the thin meninx or *pia mater* of the braine, which inuesteth the nerues of the yarde, in which certaine circles are to be seene; & beside there is in it an exquisite sence to make it capable of the pleasure which the seed in his passage through it stirreth vp, and againe it circumscribeth or limiteth the circumference of the Canale or pipe.

The other Membrane is outward and fleshy, compounded of transuerse fibres for the better expulsion of the seed and vrine.

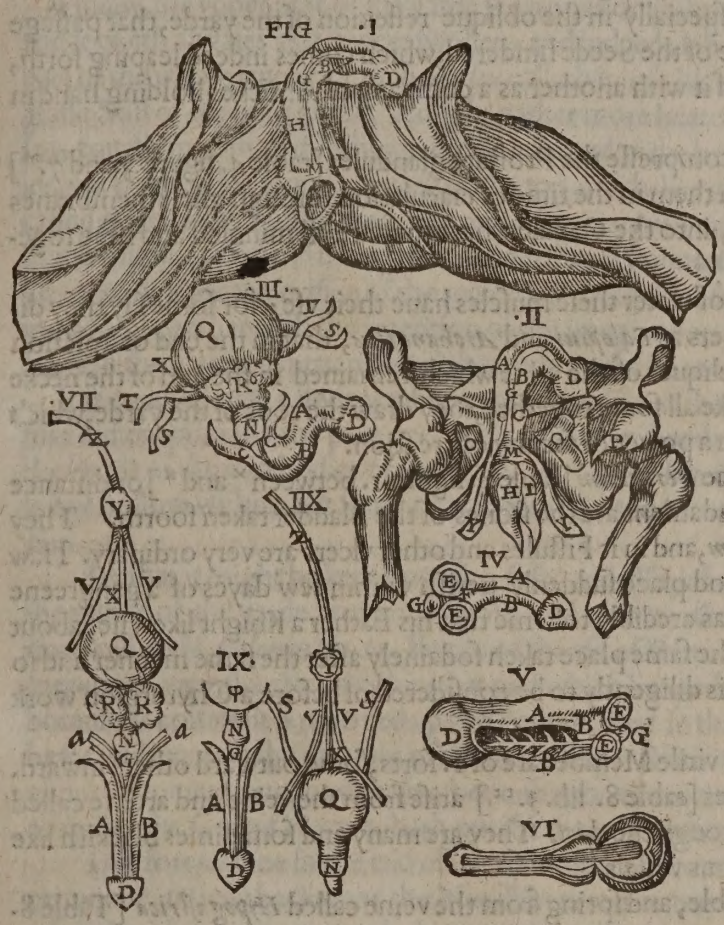
The middle substance of this pipe is lax [table 4. fig. 6] fungous or spongy and blackish so that it readily distendeth it selfe togither with the neruous bodies in the effusion of seed, and againe as readily faleth in the euacuation of vrine.

A common passage.

This passage is common to the Seede, the oylie humor issuing from the final bladders before spoken off and the vrine; and in the forepart of the Nut it hath a yawning out-let, by which these substances are auoyded. It is narrow in young folk, in others so much broader

Tab. 4. demonstrateth the muscles of the yard of the fundament and of the bladder, and the three bodies of the yard.
The first and second figures shew the yard excoriated, cleauing yet to the bottome of the share bone.
The third sheweth the same separated with his vessels.
The 4. and 5. the yard cut away, and Dissected ouerthwart.
The 6. the canel or pipe of the yard, diuided at the entrance into the bladder.
The 7. the forepart of the bladder and the yard, together with the vmbilical vessels.
The 8. the bladder of a woman, with the vmbilical vessels, and a part of the Vreters.
The 9 sheweth the backe parts of the body of the yard.

TABVLA IIII.



A B,1,2,3,4,5,7,9. the 2. bodies which make the yard.
CC 2,3. the place where these two bodies do first arise.
D 1,2,3,4,5,7,9. The nut of the yard called *glans penis*.
EE 4,5. the fungous and redde substance of the bodies of the yard.
F 4,5. the mutuall connexion of the bodyes of the yard, and the neruous outward substance of the same, compassing rounde about the former fungous substance.
G 1,2,4,5,7,9. The passage of the vrine, or common pipe running vnder the yarde, all along his length.
H,I,1,2. the first paire of Muscles of the yard which in the first figure do yet grow to it, but in the second they hang from their originall.
K,L,1,2. The second paire of Muscles of the yard, in the first figure growing, in the second hanging from their insertion.
M 1,2. the sphincter of the right gut.
N 3,7,8,9. the round sphincter Muscle of the bladder.
OO *A* Membrane which is ouer the holes of the share bone.
P 2. *A* rounde Ligament from the meeting of the share bones vnto the heade of the thigh.
Q. 3,7,8. The body of the bladder.
R, 3, 7. the *Prostatæ* into which the seede when it is perfectly laboured, is led.
SS, 3, 8. Portions of the vreters.
TT 3, Portions of the vessells which leade downe the seede.
VV, 7, 8, the vmbilicall arteries.
X, 7, 8. the ligament of the bladder cald *Vrachus*
Y, 7, 8. the nauel or *vmbilicus*.
Z, 7, 8. the vmbilicall veine.
a a 7, the veine and artery of the yard.
b 5. the artery distributed through the bodye of the yard.

der as the skin is more or lesse retracted or drawne backe from it. *Vesalius* maketh mention of a student in the Law at *Forum Iulij*, who had two distinct passages, one for vrine another for seede, but that is indeede very rare. For, because the bladder was scituated so neere, it was not necessary that another passage should bee made for the auoyding of vrine, but Nature contented her selfe to vse that already prouided for the effusion of seede. Wherefore the necke of the bladder is carried vpwarde from the Fundament, vnto the beginning of the yard.

A straunge thing obserued by *Vesalius*.

But because these officies are performed by voluntary motion, it was requisite that it should also haue Muscles. It hath therefore diuers Muscles, of which no doubt *Galen* wrote precisely in his Books *de Anat. administrationibus*, but we haue lost fiue Books and a halfe of that worthy labour, beside other peeces of excellent vse, as wee may gather by those that remaine. In the fifteenth Booke *de vsu partium*, he reckoneth but two Muscles of the yard, which saith *Vesalius* I could neuer finde. *Laurentius* describeth foure, so will we also according to *Bauhine*. Two Collaterall on each side one, which do arise neruous from the appendix of the hips, [Tab. 4. fig. 1, 2 *k l*, in the first figure they cleaue to their originall, in the second they hang downe to their insertion] below the originall of the bodies whereof the

The Muscles of the yarde.
Some of *Galens* workes lost.
Vesalius.
Laurentius.
Bauhine.
Two collaterall.

yard

yarde is made; afterward they become fleshy, short and thicker then those that follow; and being obliquely carried vpward, they are inserted into the bodies of the yarde not far from their originall [table 4. figure 2.^{cc}] and being together contracted in the act of generation, doe bend the yarde and sustayne it whilest the worke be performed; as for the erection it selfe, we haue sayed before it is made by a voluntary constriction of the sphincter muscle of the fundament, driuing the blood and spirits vnto it. *Columbus* also saith that these muscles haue some vse in our making water.

Columbus.

The other two muscles of the yarde are called *inferiores*, because they are scituate vnder the pipe, [table 4. figure 1.2.^{ll} in the first figure they appeare yet cleauing vnto it, but in the second they hang downe from their originals] on each side one, arising fleshy from the sphincter of the fundament. [table 4. figure 1.^{M}] They are somewhat long and are on their insides vnited and so carried along directly vnder the Canale, and implanted at the sides [table 4. figure 1.º] of the same, (and being diuided one from another, doe a little embrace the bodies of the yarde) that they may dilate the lower part of the Canale on both sides drawne downeward, the yarde remayning erected, and so make it shorter least in the repletion of the neruous bodies, especially in the oblique reflexion of the yarde, that passage should be stifled and so the issue of the Seede hindered, which comes indeed leaping forth, and yet is continued one part of it with another as a company of Antickes holding hand in hand, do vault vpon a stage.

2. Inferior.

Comparison.

Moreouer these muscles do compresse the Prostate glandules [table 4. figure 3. and 7.^{RR}] and straine the Seed that filleth them in the time of eiaculation through their membranes by graines as wee sayed before, into the Canale where they are all mingled and issue together.

The vses of the muscles.

In miction also or making of water these muscles haue their vse; for some say they distend the passage as *Vesalus*, others as *Falopius* and *Archangelus*, that in the end of miction they expresse or driue out the reliques of the vrine which remained in the end of the necke of the bladder. But if they worke all foure together, they draw the root of the yarde, which as well as the body thereof hath a power or faculty of erection.

Where they cut for the stone.

Betweene these muscles in the *Perinæum* [table 4. figure 1. between ^{M} and ^{R}] or distance betweene the Cod and the Fundament are the stones of the Bladder taken foorth. They call the place also *inter-fœminium*, and in it Fistules and other vlcers are very ordinary. I saw a Knight of Lincolnshire of good place suddenly perish within few dayes of a gangreene new risen in this place, and it was credibly told me that his Father a Knight likewise, about the same age of his life was in the same place taken sodainely after the same manner and so perished. Wherfore this place is diligently to be considered of before a Chyrurgion work vpon it.

A story.

A caueat for Chirurgions.

The vessels of the yarde. Veines.

The vessels that come to this virile Member are of 2. sorts, some outward others inward. The outward veines and arteries [table 8. lib. 3.^{tt}] arise from the veine and arterie called *Pudendæ*, and are distributed through the skin. They are many and sometimes blackish like vnto bodden, bursten or varicous vessels.

The internall veines are double, and spring from the veine called *Hypogastrica* [Table 8. lib. 3.^{uu}.] These when they come vnto the middle bifurcation at the Crotch, doe almost alwayes vnite into one, which is carried along the body of the member in the middest among the arteries. From this veine a notable braunch atteyneth into the capacity or cauitie of the *Abdomen*, and is disseminated through a Ligament which tyeth the bladder to the share-bones.

In like manner two internall Arteries and those very notable are inserted into the bodies of the yarde, from the Artery called *Hypogastrica* [Table 8. lib. 3.^{uu}] at the byfurcated originall of the same. The invention of these arteries *Vesalius* attributeth vnto himselfe, as also the demonstration of their vse, whome *Columbus* taxeth; but *Archangelus* auoucheth that all the three sortes of vessells in the yarde are so conspicuous that hee that is halfe blinde may see them; for being nourished sayeth hee, why should it not haue veines as wel as other parts; liuing why should it not haue Arteries, and mouing why should it not haue Nerues. *Bauhine* is of another minde, to wit, that the arteries are the vehicles of his nourishment which is thicke bloud, and that the same arteries doe also deriue vnto it the mouing faculty, but of that more hereafter. We will return. Between the forenamed arteries in the middest passeth a veine through the backe of the yarde euen to the Nutte or glans, where it is implicated or foulded together with a nerue (which haply make the substance

Arteries.

Vesalius. *Columbus.* *Archangelus.*

Bauhines conceite.

of

of the Nut fungous) all which conuey bloud and ſpirites into the ſpongy ſubſtance of the yarde when it is prouoked or chafed.

It hath alſo Nerues ſo notable ſayth *Falopius* that he that hath but halfe an eye may ſee them; *Galen* alſo in his 14. Booke *de vſu partium* and the 13. Chapter taketh knowledge of them. They proceede from the marrow of the great or holy bone, of which ſome that are cutaneous doe paſſe into the skinne of the yarde and the Teſticles, to make them ſenſible of outward iniuries, others are inward on each ſide one and that very notable, which aſcendeth vnder the ſhare-bone through the middle bifurcation to the coate of the yarde, and from thence runneth diuerſly diſperſed to his muſcles and to his whole body, togither with the arteries through his back, as farre as to the Nut or glans, to giue it a more exact ſence, eſpecially the Nut where it is of moſt vſe to ſtirre vp pleaſure in the act of generation. In theſe Nerues hapneth that tumor which we call γάγγλιον, that is a knotty tumor of a ſinew reſiſting the finger that preſſeth it, yet not dolorous; which *ganglia* here are the cauſe that when the yarde is erected ſtiffe like a Rams horne as *Falopius* ſpeaketh, it is not diſtended beyond his ordinary magnitude, but onely groweth full and turgid.

His nerues. *Falopius.* *Galen.*

Ganglia what they are.

Finally, the vpper part of the yarde is carnous or fleſhy [table 4. figure 1.2.3.4.5.7.9.ⁿ] and looketh alwaies as if it were ſwollen; and indeede it hath a greater compaſſe then any part of the whole trunke as *Archangelus* calleth it, of his body, that like the bottome of a glaſſe Still or cupping glaſſe, it might gather more heate vnto it ſelfe then any other part. It is equall, ſmooth, and turbinated, that is, broad at the baſis or bottom, and growing ſmaller, yet keeping his roundnes euen to the top, much like a Turkes cap or turbant, and it is called glans or the Nut of the yarde, and it is girt with a circle like a crowne. It is very ſoft that it might not offend the wombe, ſomewhat acuminated or ſharpned alſo at the top the better to fit it for the orifice of the matrixe; of exquiſite ſence it is, that in the attrition and motion, together with the intention of the imagination (which is moſt powerfull in both ſexes in the matter of procreation) the ſeede might be more plentifully eiaculated.

The glans or nut of the yarde.

His figure.

Subſtance.

It is couered with a fine membrane, produced from that membrane which wee ſayed before did encompaſſe the pipe or Canale; and it groweth not vnlike to a muſhrum vppon the heads of the two bodies of the yarde. Itis as we ſayed of a ſpongy ſubſtance, which yet is not hollow within, but ſomewhat more ſolid and firme then other ordinary ſpongy bodies.

His mebrane.

But that it might be kept ſmooth, ſoft and glib, it hath a couering which ariſeth from the skinne of the yarde brought forward, and againe reflected or returned, which the Grecians call πόσθη, *Galen* in his 15. Booke of the vſe of Parts calleth it *Cutis epiphyſin*, in Latin *præputium*, we cal it the fore-skin; that part which hangeth ouer the end is called ἀκροπόσθιον, becauſe in coition it is mooued vp and downe, that in this attrition it might gather more heate and increaſe the pleaſure of the other ſexe. Some ſay it was ordained for ornament alſo, and not without good reaſon, becauſe vpon the more diſhoneſt part, God & Nature, or rather the God of Nature, hath put the more honour, that is the more couering.

The prepuce or fore-skin.

This fore-skinne in the end of it is ſometimes ſo contracted or drawne together, that it cannot be drawne backe, nor the Nut diſcouered without the helpe of a Chyrurgion. But when the Nutte is vncouered, that it may recouer his couer againe, this prepuce is tyed in the lower part with a membranous band or tie, which the greekes call χαλινὸν, ſome κύων and κυνόδεσμον, *vinculum caninum*, the Latines *frenum*, in Engliſh the bridle. *Archangelus* calleth it a Ligament, others will haue it to be made of the extremities or ends of the ſinewes, and this is it which bridleth or reyneth vp the fore-skinne on the lower ſide to the toppe of the Nut. It alſo furthereth the profuſion of ſeede, communicating by the Canale motion and heate to the proſtate glandules which conteine the ſeede ready for eiaculation. For oftentimes in luſtfull diſports or imaginations, if this bridle be but lightly moued, the ſeede will incontinently iſſue foorth; euen as after a full meale, if a man but touch the end of his throate with his finger, the ſtomacke by reaſon of the continuity of the parts, contracteth it ſelfe and returneth the *crapula* or vndigeſted gobbets into the lap by vomit.

In the middeſt of this Nut is a paſſage or hole through which both the ſeede and the vrine is powred foorth, for it compaſſeth the common Canale at which place it is larger, but preſently is contracted againe, that the ſeede hauing there a kinde of momentanie ſtay or ſtop, might procure more pleaſure in this part. Wherefore thoſe that labour of the *gonorrhæa* cauſed by the acrimony of rotten ſeed heaped vp in this large place, are here tortured with vlcers.

The

The vse of it.

The vse of the Yard is as hath beene saide in the particular parts thereof; onely wee will add, that the auoiding of vrine was not the cause of the making of this member. (For we see women make water without it) but for procreation. Euen as Nature hath ordayned the nose for smelling, yet shee vseth it secondarily for purging the mucous excrements of the braine. So vpon a second intention this member serueth to deriue away the vrine wherewith otherwise we should lightly defile our selues.

And thus much shall suffice for the parts of Generation in men, wherein I haue bin indeed as particular as the Anatomicall History did require, but yet withall hope I shall finde pardon, because the Reader may perceiue (at least if he haue any knowledge) that I haue pretermitted many secrets of Nature, which I could and would heere haue somewhat insisted vpon, if I had imagined that all into whose hands this worke should come had bin competent and fit Auditors for such kinde of Philosophy.

CHAP. IX. *Of the proportion of these parts both in Men and Women.*

The same parts of generation in men and women.

IT was the opinion of *Galen* in his 14. Booke *de vsu partium*, and the 11. Chapter, that women had all those parts belonging to generation which men haue, although in these they appeare outward at the *Perinæum* or *interfœminium*, in those they are for want of heate retained within; for seeing a woman is begotten of a man, and perfect also in makind (for Natures imperfections are not so ordinary) it is reasonable that the substance, yea and the shape of the parts in both sexes should bee alike, as comming from one and the same *set* as it were of causes. Neither is it so vncouth in Nature, that those partes which in some creatures are prominent and apparent, should in others be veyled and couered: for Moles indeede are not without eyes, but haue them lying deeper in their heads and ouer-

Virgil 1. *Georg.* couered, whence *Virgil* saith, *Aut oculis Captis fodere cubilia talpæ*, that is;

Or hood-winkt Moales haue dig'd their Bowers.

The wonderful prouidēce & wisedom of God.

So we call captiues, not those which are not at all, but which are in restraint or in bands. Although heerein Nature hath excellently acquitted her selfe, that the abatement of naturall heate, which in men is the onely naturall and necessary cause of their dissolution, should so admirably become in women the original of generation, whereby we should attaine a kinde of eternity euen of our bodies, against the destinated corruption of the matter, arising from an importunate discord of contraries. For so it pleased the Diuine Wisedome to create for the eternall soule (the most excellent of all formes) if not an eternall habitation heere, yet so absolute and admirable a structure, as might so long bee perpetuated below, till it come to be eternized aboue after an ineffable manner of recreation.

To bring a kind of eternity out of imperfection.

The particular partes of Generation in women.

Wherefore to return. In this other sexe, there are some partes which bring downe the matter of seede out of the whole bodie, to wit, the spermaticall Veines and Arteries; others worke and labour it into good seede, as the body called *Varicosum* and the testicles; others leade the perfected seede, called as in men *vasa deferentia* or leading vesselles; Lastlie, the wombe or Matrixe which receyueth the seede together with the mans, receyneth it, and worketh vpon it for the generation and preseruation of mankinde. This wombe is likened by *Galen* in his 4. Booke *de vsu partium*, and the sixt chapter, to the *scrotum* or cod of a man [Tab. 11. fig. 1] as if the cod were but a womb turned the inside outward, and hanging forth from the Share-bone; and *Archangelus* maketh no other difference betweene them but of scite and insertion. For if a man doe imagine the cod to be turned and thrust inward, betwixt the bladder and the right gut, then the Testicles which were in it will nowe cleaue to it outwardlye on either side, and so that which was before a cod will now bee a perfect Matrixe.

Galen. The womb is like the *scrotū*.

The necke of the womb like the virile member

Againe, the neeke of the wombe (saith he) is instead of the yard, for they are both of a length, and by friction and refriction the seede is called out of the like parts, into the same passage, onely they differ in scituation which is outward in men, inward in women. *Fallopius* frameth the comparison of the parts somewhat after another sort, as we shall see heereafter when we come to the Controuersies.

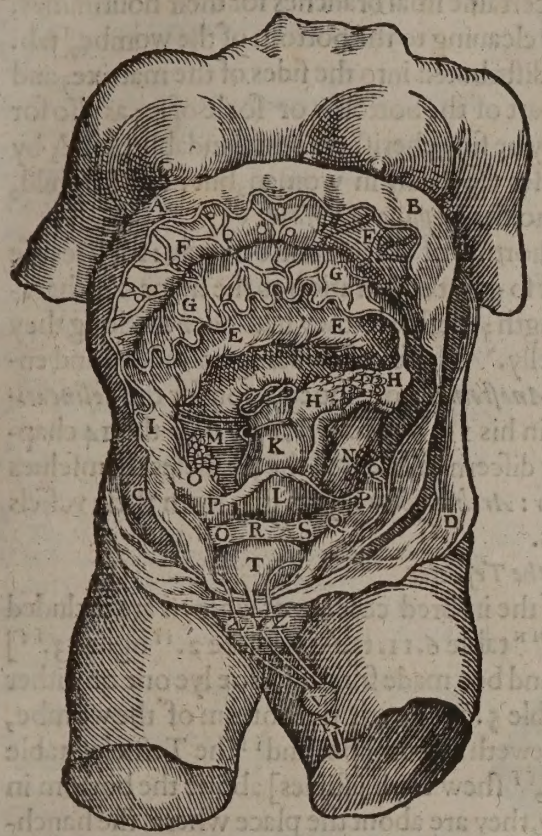
The cause of the procreation of a woma.

So then, in the first conception or soon after, whether it be in man or woman, the same Members are generated, but the fruite prooueth male or female, because of the temper of the seede and the parts of generation, either by heat thrust out, or for want or weakenes of the heate reteined within: wherefore a woman is so much lesse perfect then a man by how much her heate is lesse and weaker then his; yet as I saide is this imperfection turned vnto

per-

Table 5. ſheweth the lower belly of a woman, the guts being taken away.

TABVLA. V.



A, B, C, D. The inner face of the *Peritonæum* reflected.
E E. That part of the Meſentery which ioyneth together the ſmall guts.
F F. The Membranes of the *meſentery* diuided aſunder.
G G. The courſe of the veſſels and Glandules in them.
H H. I. That part of the Meſentery which tieth the right and the left part of the Collick gut.
K. The right gut cut off.
L. The bottome of the wombe whole.
M, N. Both the Teſticles.
O O. Q. Q. A Membrane of the *Peritonæum* which tyeth the wombe, her veſſelles and the Teſticles vnto the backe, it holdeth vppe the wombe, and with the Membrane of the other ſide, it maketh the ſeconde coate of the wombe.
P P. Fleſhie Fibres which runne into this Membrane, making the right and left Muſcles of the wombe.
R S. The necke of the wombe betweene R and S. couered yet with that Membrane.
T. The backe ſide of the bladder.
V. X. The Nauell, with part of the Vmbilicall Veyne at X.
Y. The Ligament of the bladder in bruite Creatures, *Vrachus*.
Z Z. The two vmbilicall Arteries.

perfection, becauſe without the woman, mankinde could not haue beene perfected by the perfecter ſexe. The great Maiſter workman therefore of ſet purpoſe, made the one halfe of mankinde imperfect for the inſtauration of the whole kinde, making the woman as a receptacle of the ſeede of which a new man was to be created. Wee haue therefore in this fift Table exhibited the lower belly of a Woman, and remooued the guts that all thinges might be more conſpicuous, but now let vs come to the particular partes in a woman, beginning firſt with the ſpermaticall veſſels.

CHAP. X. *Of the preparing Spermatical veſſels.*

THE ſpermaticall veſſels which bring the ſeede from the whole bodye, and prepare it for further vſe, are foure. Two Veines, and two Arteries. *Galen* in his Booke *de diſſectione vteri*, maketh mention of foure other veſſelles obſerued by *Herophylus* in ſome women, which ariſe (ſaith he) from thoſe veſſels which go vnto the Kidnies, and ſo paſſe into the womb, which ſaith *Galen* I could neuer finde in any creature, but onely in Apes. The right veine buddeth out of the [Tab. 6.dd] trunke of the hollow vein below the emulgent, nere the great or holy bone; the left proceedeth [Tab. 6.ee] from the left Emulgent, becauſe on this ſide the great Artery is ſcituated neere the hollow veine, which Artery mooueth or beateth continually, ſo that if this left ſpermaticall veſſell had proceeded out of the trunke of the hollow veine, it muſt of neceſsity haue bin carried ouer the great Artery, and then this thin veine had bin in continuall danger of breaking by the inceſſant motion of the arterie. The ſpermaticall Veines.

But both the Arteries [Tab. 6.gh] ariſe from the trunke of the great Arterie vnder the emulgent neere the great bone, and are full of ſprightfull blood. *Galen* recordeth, that *Ariſtotle* and *Eraſiſtratus* thought they conteined nothing but ſpirits, with whom *Bonaccio-lus* and *Mercatus* ſeeme to conſent. And although theſe haue the ſame originall with the Arteries of a man, yet do they not, as in men, fal out of the *Peritonæum*, neyther reach vnto the Share-bones (for it was not needfull that women as men ſhould caſt their ſeede out of themſelues, but onely into their matrix) neither are they mingled together, or growe one into another before they come vnto the teſticles, althogh *Veſalius* would haue it ſo. Wherfore they vary in their inſertion and diuiſion. For in women they are ſupported with fat The ſpermaticall Arteries.

membranes [table 7. figure 1. [EE]] and so are carried to the Testicles [tab. 6. [ii] tab. 2. fig. 1. [f]] but before they come there, after an inoculation or Anastomosis made between the veine and the arterie; they are diuided saith *Galen* in his 14. Book *de vsu partium* & chap. 9. into 2. parts; one part maketh the seminarie vessell [table 7. figure 1. [IK]] and the *corpus varicosum*, communicating to the Testicles & their coat certaine final branches for their nourishmēt.

Diuided into two parts. The first.

The other part reacheth to the membrane cleauing to the bottom of the wombe, [tab. 6. [ll] table 7. [ll] fig. 1. fig. 2. [ff] fig. 3 [bb]] and so is distributed into the sides of the matrixe, and carrieth nourishment especially to the vpper part of the bottome or soale of it; as also for the nourishment of the conception, that it may be fitly cherished with laudable bloud; by which vessels also a part of the menstruall courses especially in women, but not with child, is purged, but in men they are all consumed into the *corpus varicosum*.

The second.

They differ also from mens vessels in the shortnes of their course or way: for because the seede of the women stoode not in neede of so great elaboration as the mans did, therefore there was no necessary vse of the same length; beside if they had beene so long they could not haue beene contained within the belly. These vessels being enfoulded and enwrapped one within another by an admirable *Anastomosis* or inoculation for the *delineation or perfection* of the seed, make (sayth *Galen* in his 14. Booke *de vsu partium* the 14 chapter) if any, yet very small *parastatæ* and scarcely discerned, because the Testicles themselues are small and the spermaticall vessels small also: *Archangelus* sayeth that from these vessels goe vnto the Testicles certaine small branches.

How they differ from the arteries in men.

The *Parastatæ* in women very small.

CHAP. XI. *Of the Testicles.*

THE Testicles which because of the in-bred coldnes of women are included within the lower venter [table 5. [MN] table 6. 11. table 7. figure 2. [ii] figure 3. [ff]] that they might be kept warme and bee made fruitfull, doe lye one on either side at the sides of the matrix [table 5. [L] sheweth the bottom of the wombe, and [MN] the Testicles, table 6. [P] sheweth the wombe, and [ii] the Testicles, table 7. figure 2. and 3. [c] sheweth the wombe, and [ii], [ff] shew the Testicles] aboue the bottom in women not with childe, but in those that bee, they are about the place where the hanchbones are ioyned to the great or holy-bone, and are contained in loose membranes [table 5. [oo] [qq] table 7. figure 1. [EE] table 10. [MN]] arising from the *Peritonæum* which couer also the middle part of the Testicles.

The position of the testicles.

They differ from mens Testicles in scituation, for they lye vpon the muscles of the loynes within the *Abdomen*; in Figure because they are not so thicke or rounde, but before and behinde broad and flatted; [Table 7. figure 2. [ii]] their vpper face is vnequall as if they were many small glandules [table 7. figure 2. [ii]] (like the glandules of the Kell and mesentery sayth *Vesalius* and with him *Platerus*) and those vnequall (for some are greater & some are lesser) ioyned together. Long they are [Table 7. figure 1. [r] figure 3. [ff]] sinuous or hollow, and beside smal textures in the vessels themselues, they abound with a wateriſh humor like the thickest whay: In hayle women they are full of this liquor, in those that be sick like bladderts filled with a watery humour, sometimes cleare, sometimes of a yellow or saffron colour and of very euill sent, from whence is often caused the strangulation or suffocation of the matrix, which we call fits of the mother. *Vesalius* telleth two tales of two women in whose testicles he found a very noysom and ill sented humor, one of which died in such a fit.

How they differ from mēs in scituation. Figure. *Platerus.*

In the contents.

The suffocation of the matrix.

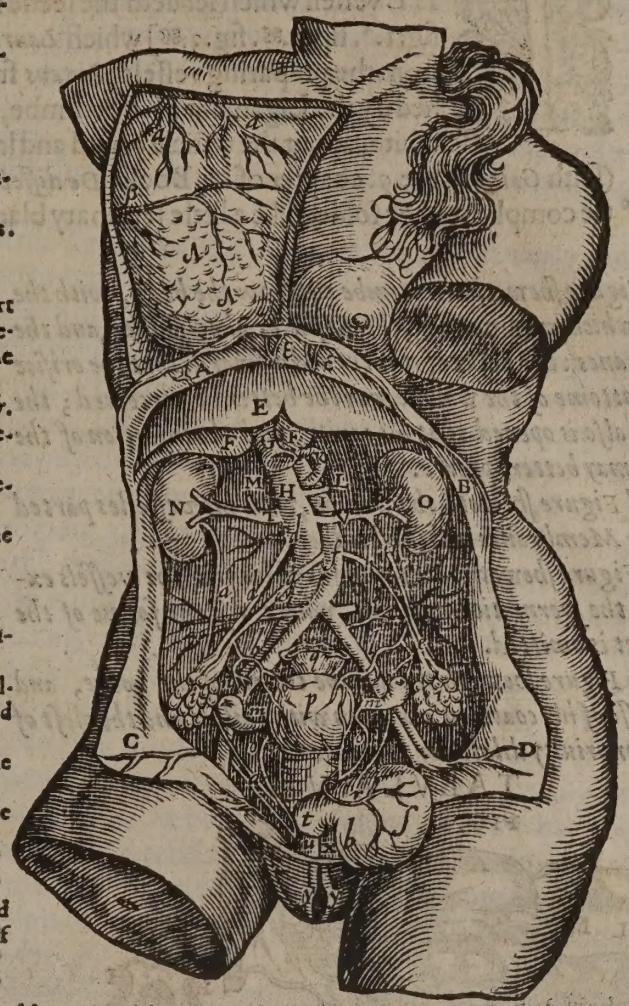
They differ also in magnitude for they are much lesse in substance, because they are moister and softer, yet *Vesalius* thinks they are harder then in men. Neither is their substance so compact, because they were to ingender a more imperfect seede. In Temperament they are colder, whence womens seed is more moyst, thinne and wateriſh. It may be, that of this thinnes as it were of water, and of the seede of the man which is thicker as it were of flower a certaine paste should be made in the wombe to bee fermentated or wrought vp into the form of a man; or because *Hippocrates* sayth that man consisteth of water and fire, we may say that the seede of the women is the water, and that of the man the fire, because as the fire it carrieth in a smal body or matter, a great deale of actiuity or form; although I am not ignorant that this of *Hippocrates* is & may be otherwise taken, as that both the seeds are the water, and the spirit is the fire; which Nature by the helpe of an aduentitious heate doth extract and segregate from the more excellent part of the seed, especially of the man, lying before hid in the power or possibility of the matter, which is called by Scholers *potentia materiæ*; which spirit assisted by the formatiue faculty of the womb, doth with a discerning iudgement deduce and distinguish into proper acts the power or possibility of the parts

Magnitude. *Vesalius.* Temperament. Man like a lump of dow.

Womens seed water, mans fire. *Hippocrates.* *Hippocrates* meaning.

Table 6. sheweth the lower Belly the Guts being taken away, as also the Stomacke, the Mesentery, and some membranes, that the vessels serving for generation may the better be discerned. Also the Breast or Dug of a woman excoriated, is here exhibited.

TABVLA VI.



ABCD The *Peritonæum* reflected or returned backeward, aboue and below.
EF The gibbous part of the Liuer E. the caue or hollow part F.
G The trunke of the gate veine.
H The hollow veine.
I The great artery.
K The rootes of the *Cœliacall* artery which accompanieth the gate veine.
LM The fatty veine going to the coat of the kidnies.
NO The fore part of both the kidneyes.
TV The emulgent veines and arteries.
aab The right vreter at the lowest *a* cut from a part which neare to *b* sticketh yet to the Bladder, because the bottome of the bladder is drawne to the left-side.
c The left vreter inserted into the bladder neare to *r*.
dd The spermaticke veine which goeth to the left testicle marked with *i*.
ee The spermatick veine which goeth to the left testicle marked with *i* also.
f The trunke of the great artery from whence the spermaticall arteries do proceed.
g h The spermaticall arteries.
i i The two testicles.
ll A branch which from the spermaticke vessels reacheth vnto the bottom of the wombe.
mm The leading vessell of the seed which *Falopius* calleth the *tuba* or trumpet, because it is crooked and reflected.
n A branch of the spermaticke vessel compassing the leading vessell.
o o A vessell like to a worme which passeth to the wombe, some call it *Cremaster*.
p The bottome of the wombe called *fundus vteri*.
q A part of the right gut.
r s The bottome of the Bladder whereto is inserted the left vreter, and a veine ledde from the necke of the wombe neare vnto *r*.
t The necke of the Bladder.
u The same inserted into the priuity or lap. *x* A part of the necke of the wombe aboue the priuity. *yy* Certaine skinnie Caruncles of the priuities in the middest of which is the slit, & on both sides appeare little hillocks.

The Figures belonging to the Dugs or Breasts.

αα The veins of the dugges which come from those, which discending from the top of the shoulder, are offered to the skin. *ββ* The veines of the dugges deriued from those which through the arme-hole are led into the hand. *γ* The body of the dug or Breast. *δδ* The kernels and fat betweene them. *εε* The vessels of the dugs discending from the lower part of the necke called *iugulum*, vnder the Breast bone.

parts mixed together confusedly in the masse of seed. This spirit also moueth & illumineth all the parts & moderateth all the actions of mans life, of which it is also chiefe cause. And therefore it is that we say, that the seed of a man is the actiue principle of the body, that of women but the passiue, or at least far lesse actiue thē the other. But if the seed of both sexes had beene thicke, glewy and compact, they could not haue been so perfectly mingled. Finally, they differ in their coats or couerings, for they haue but one, [tab. 7. fig. 1.ˣ] because being conteyned in a hidden and safe place they needed no more: that coate *Galen* calleth *dartos*, and it is thinner & softer then that in men, but cleaueth to the testicles very strongly, as if it were one body with them. This coat also receiueth the vessels of seed, and inuesting their substance conteyneth it or holdeth it in. The productions also of the *Peritonæum* doe incompasse only the middle part of the testicles where they receiue the spermatical vessels.

They differ in their coats.

The vse of the Testicles as say *Columbus*, *Archangelus*, *Laurentius* and *Bauhine*, is by their in-bred power to make the seed fruitfull. *Falopius* is not of this mind, *Platerus* halteth betwixt both; but we know assuredly that those women whose testicles are ill disposed are barren and vnfruitfull: for women as well as men do yeeld seed, but cold, though *Aristotle* deny it in his first book *de gener. Animal.* and the 20. chapter; who would haue that humor which is auoyded by the necke of the matrix not to bee a seminarie or seedy humour, but a proper humor of the place, to wit, an excrement of the womb, which also should be found in some, but not in others; as especially browne or swart coloured and manniſh women. But *Hippocrates* in his first Booke *de dieta*, and in his booke *de natura pueri*; and *Galen* in his 14. Booke of the *vse of parts* and the 11. Chapter haue taught; that to perfect generation there is required a concurrence and mixture of the seeds of both sexes; and a place wherin the forme of the parts being onely in power present; the feede might be brought into act, such is the wombe; of which we shall heare by and by.

The vse of a womans testicles.

CHAP. XII. *Of the vaſa deferentia or Leading veſſels.*

Laurentius a Caſtro. Pinæus.

THE veſſell which leadeth the ſeede is on either ſide one [Tab.6.mm. Tab.7. fig.1.*. fig.2.gg. fig.3.gg] which *Laurentius* and *à Caſtro* woulde haue to ariſe from the preparing veſſels, *Pinæus* from the Teſticles. It is ſaide to be ſuſtained by the Ligament of the wombe, as it were with a prop. Neruous it is & white, about the teſticle broad and large, [Tab.6.mm. Tab.7.fig.1,*.fig.2.gg] (ſaith *Galen* in the 9. chapter of his Booke *De diſſectione vteri*,) membranous alſo, and a little complicated or folded like a little ſeminary bladder beeing rugous, ſuch as in men is at

Their ſubſtãce *Galen.*

The firſt Figure ſheweth the wombe cut from the body, with the veſſels which grow vnto it, the Teſticles, the Bladder, and the Membranes: the necke of it is turned vpward, that the orifice of the bottome of the wombe may the better be perceiued; the bladder alſo is opened, that his cauity, and the inſertion of the Vreters may better appeare.

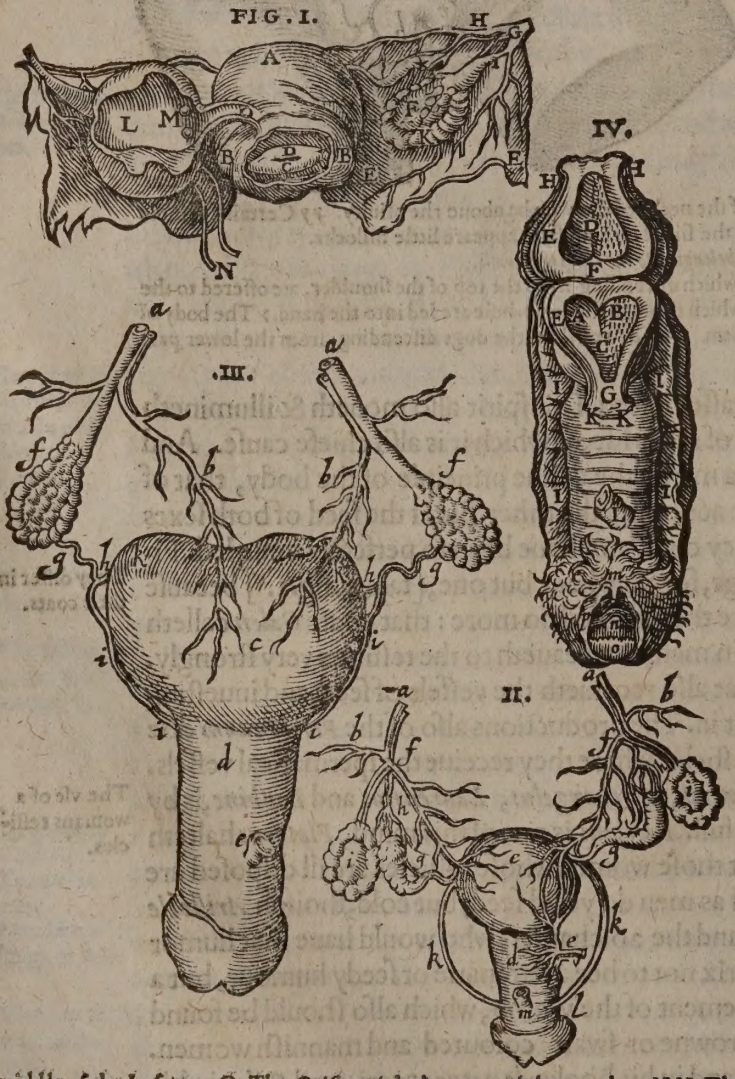
The ſecond Figure ſheweth the wombe, with his veſſelles parted from the Membranes and the bladder.

The third Figure ſheweth the womb freed from al the veſſels excepting the ſpermaticall veſſels, where alſo the forme of the Trumpet is omitted.

The fourth Figure ſheweth the wombe cut out of the bodye, and thickneſſe of his coates in a woman with childe, and the cleft of the lap or priuity dilated or laide open.

TABVLA. VII.

FIG. I.



A. The bottome of the wombe laide open without any Membrane.
B B. The necke of the wombe turned vpward.
C D. A part of the bottome of the wombe like the nut of the yard, ſwelling into the vpper part of the necke of the wombe, in the middle whereof the orifice appeareth.
E E. A Membrane knitting the wombe to the *Peritonæum*, and holding together the veſſels the reof.
F. The left teſticle.
G. The ſpermaticall Veine and Artery. *
H. A part of the ſpermaticall veſſelles reaching vnto the bottome of the wombe.
I. One part of the veſſels comming to the Teſticle.
* A veſſell leading the ſeede vnto the wombe.
K. The coate of the teſticle with the implication of the veſſels.
L. The cauity of the bladder opened.
M. The inſertion of the Vreters into the bladder.
N. The Vreters cut from the Kidneyes.
O. The inſertion of the neck of the bladder into the lap or priuity.

The ſecond Figure.

a a. The ſpermaticall Veine and Artery.
b b. Branches diſtributed to the *Peritonæum* from the ſpermaticall veſſels.
c The bottome of the wombe.
d The necke of the wombe.
e Certaine veſſels running through the inſide of the wombe, and the neeke thereof.
ff Veſſels reaching to the bottome of the wombe produced from the ſpermaticall veſſell.
g g The Leading veſſel of ſeed called *Tuba* the trumpet.
h h A branch of the ſpermaticall veſſell compaſsing the trumpet *i i.* The Teſticles.
k k The lower Ligaments of the wombe, which ſome call the Cremaſteres or hanging Muſcles of the wombe.
l the lap or priuity into which the cremaſteres do end
m A portion of the necke of the bladder.

The third Figure.

a a. The ſpermaticall veſſels.
b b. A branch from theſe ſpermaticall veſſels to the bottome of the wombe.
c c The bodie or bottome of the wombe.
d The necke of the ſame.
e The necke of the bladder ending into the necke of the wombe. *f f.* The teſticles.
g g The leading veſſels, commonly though not ſo wel called the eiaculatory veſſels.
h h The diuiſion of theſe veſſelles, one of them determining into the hornes at double *k k*.
i i The other branch ending in the necke, by which women with childe auoide their ſeede.
k k The hornes of the wombe.

The fourth Figure.

A B. The boſome of the bottome of the wombe, at whoſe ſides are the hornes.
C D. A line like a ſuture or ſeame, a little diſtinguiſhing that boſome.
E E. The ſubſtance of the bottome of the wombe, or the thickneſſe of his inward coate.
F. A protuberation or ſwelling of the wombe in the middle of the boſome. G. The Orifice of the bottome of the wombe. H H. The coate or ſecond couer of the bottome of the wombe, comming from the *Peritonæum*. IIII. A portion of the Membranes which tye the womb. KK. the beginning of the necke of the womb. L The necke of the Bladder inſerted into the necke of the womb. *m* the *Clitoris* in the toppe of the priuite. *n* The inequality of the priuity where the *Hymen* is placed *o* the hole or paſſage of the priuity in the cleft. *p* The skinny caruncle o. the priuity.

the

the *Proſtatæ*. In the middle it hath a notable hole or paſſage like the mouth of a trumpet, whence *Fallopius* calleth it the Trumpet of the wombe, and ſayeth it is found not onely in the bodies of women, but alſo of all female creatures, by which as by a breathing vent the ſmoky vapors of the womb do exhale into the capacity of the *Abdomen*; & this hole the ſpermaticke veſſels do compaſſe, [Tab. 6.nt. Tab.7.fig.2.hh] and it is curled vp after the maner of a Vine tendrill. For it is more rugous [Tab.7.fig.3.gg] and fuller of windinges then it is in men, and that becauſe of the ſhortneſſe of the way, which is recompenſed by the multitude of turnings, ſeeing it could not paſſe through the production of the *Peritonæum*, becauſe the Teſticles did not hang out.

The trumpet of the womb. *Fallopius.*

How they differ from mens

Theſe Leading veſſels hauing paſſed the Teſticles a little, become by degrees narrower, [Tab.6.mm. Tab.7.fig.1.* fig.2,gg] and are not carried as in men to the necke of the bladder, but to the wombe; and when they come to the ſides of it, [Tab.7.fig.3,kk] which are called the hornes of the wombe (from whence *Fallopius* and *Platerus* thinke theſe leading veſſels do iſſue) they are diuided on either ſide, [Tab.7.fig.3,hh] & one part which is the ſhorter and larger, is implanted into the middle [Tab.7.fig.3,k] of the horne of his owne ſide, or neere vnto it; and powreth into it and into the hollowneſſe of the wombe, ſeed perfectly boiled; but the other part which is narrower but longer [Tab. 7. fig. 3,ii] is carried along the ſides of the wombe to his necke [Tab.7.fig.3,d] on either ſide, and is inſerted below the innermoſt mouth vnder the necke into the *Proſtatæ*: which are not ſo conſpicuous as they are in men, becauſe the ſeede of a woman is not ſo corpulent or beareth not ſuch a bulke. Theſe keepe the ſeede till the time of coition, and by this way women with child in accompanying with men do looſe ſeede, and not by the inmoſt mouth of the wombe opened. For whereas after conception the mouth of the wombe is exquiſitely cloſed vp, [Tab. 7. fig.1. betweene c and D, and fig.4,c] and yet euen then women in coition do looſe ſeede; it is neceſſary the ſame ſhould paſſe ſome other way, becauſe the cauity of the wombe beeing on euery ſide filled, the ſeede that ſhould come from the bottome or ſide of it cannot haue recourſe vnto the orifice, or if it could, yet ſeeing that is ſo ſtraightly ſtopped and muſt not be recluded or opened for feare of abortment, it would follow that the ſeed putrifying the Infant ſhould periſh. For ſeede when it is out of the veſſels, cannot without great danger be reteined, yea it becommeth very poiſon, as *Galen* ſaith in his ſixt Booke *de locis affectis*, and the fift Chapter, and we alſo may plainly ſee in the greeuous fits of widdowes troubled with the Mother: wherefore this paſſage [Tab.7. fig. 3,ii] as *Varolius* rightly admoniſheth muſt be in the necke of the wombe, which in thoſe that haue not conceyued is ſo ſmal, that it cannot be perceiued vnleſſe the Anatomiſt be very diligent and occulate; but in women with childe it is very large and manifeſt. Hence it is, that many women when they are with childe, conceiue greater pleaſure in their husbandes then at other times, and alſo ſome women more then others. But *Fallopius* is of opinion, that theſe Leading veſſelles doe ariſe from the ſides [Tab.7.fig.2.s] or hornes of the womb, and are caried vpward obliquely by the teſticles; but do not ariſe from them, becauſe in ſound & haile women they are diſtant from the teſticles the bredth of a finger, neyther that there appeareth any veſſel which paſſeth from the teſticles to theſe holes or paſſages, but are onely coupled together by a thin membrane produced from the *Peritonæum*, but do not ſo much as touch one another. But if the wombe be euill affected, and that on one ſide, then the Leading veſſell is ioyned to the teſticle on the ill affected ſide, but not on the ſound; but if both ſides of the wombe be affected, then both the leading veſſels are ioyned with both the teſticles.

Their progres

The horns of the wombe.

Which way a womans ſeed paſſeth after the is conceyued.

Seede out of the Veſſelles groweth poyſonous. *Galen.* *Varolius.*

Why ſome women haue more pleaſure then others after conception *Fallopius.*

CHAP. XIII. *Of the wombe or Matrixe.*

THE womb ca'd *Vterus*, is by *Ariſtotle* called the Field of Nature, intowhich the ſeed as well of the woman as of the man, is partly powred partly drawne, to which accrueth the womans blood, that the newe off-ſpring of mankinde might be ingendred, nouriſhed, encreaſed, and kept to the due time of birth. For the Naturall and vegetable ſoule which lyeth potentially in the ſeed, diffuſed equally through the whole maſſe, muſt be produced into act; and it is ſo produced by the vertue & heat of the womb that receiueth the ſeed, and the forming faculty which potētially conſiſteth partly in the ſeed of the man, partly in the nature of the wombe, and is called *vis plaſtica*, and ſo of both ſeedes mingled are framed and procreated equally together and at one and the ſame time all the parts of the bodye, vnderſtanding their Spermaticall foundations and ſolid ſubſtance; but as for their ſanguine foundations or proper *Parenchy-*

Lib.1. de gener. Animal. Cap.2.

The forming Faculty.

How all the parts are formed at once.

mata, they are procreated at diuers times, as they ſooner or later get nouriſhment and fire, that is ſpirit; and ſo thoſe parts that are nearer to the Liuer are perfected before thoſe that are more remote, and thoſe firſt into which firſt the mothers bloud doth flow; that is, firſt the vmbilicall veine, wherefore that is firſt abſolued in his fleſhy ſubſtance, from which afterwards the bloud is led and conuayed into other parts.

The names of the wombe.

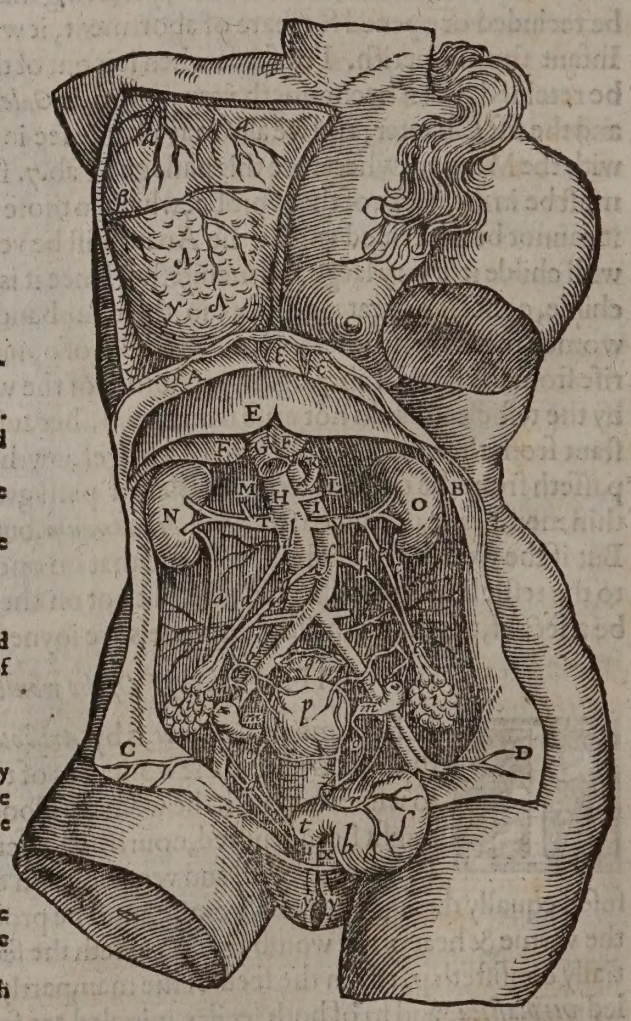
It is called *vterus* properly in women, becauſe it is hollow like a bottle, and as a bottle or bagge of leather is filled and diſtended with the Infant contained in it; *Hippocrates* calles it γονὴ; but moſt commonly the Grecians cal it ὑστέρα, becauſe it hath the laſt place among the entralles or inwards; alſo μήτρα, *mater*, or the mother, becauſe it is the mother of the Infant, ſome call it *vulua*, but that is properly in Beaſtes, as *Pliny* witneſſeth in the 37. Chapter of his 11. Booke; it is called *locus* or rather *loci*, the place of a woman.

The ſcituation & the reaſons thereof.

It is placed within the bodie [table 5.[L] table 8.[P] table 10.[L]] becauſe the ſeede after it is caſt into the womb, needed much heat to ſtirre it vp and to mooue it toward the delineation of the parts. In the lower belly (not in the middle or ſupreame for that theſe two are compaſſed with bones and cannot be dilated according to the increaſe of the infant, but would haue ſtifled it by compreſsion:) becauſe this is eaſily dilated as the burthen increaſeth, and in the lower part of it called the watercourſe or *Hypogaſtrium*, partly becauſe it ſhould be no hinderãce to the nutritiue parts, partly for the more commodious begetting &

Table 8. ſheweth the lower Belly, the Guts, being taken away, as alſo the Stomacke, the meſentery and ſome membranes, that the veſſels ſeruing for generation may the better be diſcerned. Alſo the Breaſt or Dug of a woman excoriated, is here exhited.

TABVLA. VIII.



ABCD The *Peritonæum* reflected or returned backeward, aboue and below.
EF The gibbous part of the Liuer E. the caue or hollow part F.
G The trunke of the gate veine.
H The hollow veine.
I The great artery.
K The rootes of the *Cœliacall* artery which accompanieth the gate veine.
LM The fatty veine going to the coat of the kidnies.
NO The fore part of both the kidneyes.
TV The emulgent veines and arteries.
aab The right vreter at the loweſt *a* cut from a par which neare to *b* ſticketh yet to the Bladder, becauſe the bottome of the bladder is drawne to the leſt ſide.
c The left vreter inſerted into the bladder neare to *r*.
dd The ſpermaticke veine which goeth to the left teſticle marked with *i*.
ee The ſpermatick veine which goeth to the left teſticle marked with *i* alſo.
f The trunke of the great artery from whence the ſpermaticall arteries do proceed.
g h The ſpermaticall arteries.
i i The two teſticles.
ll A branch which from the ſpermaticke veſſels reacheth vnto the bottom of the wombe.
mm The leading veſſell of the ſeed which *Falopius* calleth the *tuba* or trumpet, becauſe it is crooked and reflected.
n A branch of the ſpermaticke veſſel compaſſing the leading veſſell.
o o A veſſell like to a worme which paſſeth to the wombe, ſome call it *Cremaſter*.
p The bottome of the wombe called *fundus vteri*.
q A part of the right gut.
r ſ The bottome of the Bladder whereto is inſerted the left vreter, and a veine ledde from the necke of the womb neare vnto *r*.
t The necke of the Bladder.
u The ſame inſerted into the priuity or lap.
x A part of the necke of the wombe aboue the priuity
y y Certaine skinnie Caruncles of the priuities in the middeſt of which is the ſlit, & on both ſides appeare little hillocks.

The Figures belonging to the Dugs or Breaſts.

α α The veins of the dugges which come from thoſe which diſcending from the top of the ſhoulder, are offered to the skin.
β The veines of the dugges deriued from thoſe which through the arme-hole are led into the hand.
γ The body of the dug or Breaſt.
δ δ The kernels and fat betweene them. *ε ε* The veſſels of the dugs diſcending from the lower part of the necke called *iugulum*, vnder the Breaſt bone.

bring-

bringing forth of the fruite. The den or cauitie of the body wherein it is conteined is called *Peluis*, that is, the lauor or baſon; ſo that it is compaſſed about as with ſtrong rampires for defence, with the ſhare bones before, the great bone behinde, and the hanch bones on either ſide. I ſpeake of the wombe vnburdened, for then the bottome of it reacheth not higher then the beginning of the great bone, neither toucheth it any thing but the right gut. [Tab.5.x. Tab.8.q.] vppon which it lieth, nor reacheth forward aboue the bladder; [tab. 5.t tab.8.f.] for it is placed betweene the bladder and the right gut, that backeward it might haue, as it were, a pillow (ſaith *Galen* in the firſt chapter of his booke *de diſſectione vteri*, and and in the 14. booke *de vſu partium* and the 14. chapter) betweene it and the backebone, that it might not be hurt by his hardneſſe, and before it a ſtrong membrane, to wit, the bladder as a bulwarke to defend it.

A remembrance for proud men.

Here we may ſee the glory of the ancient habitation or manſion houſe of mankinde, how that we are bred of a brittle & periſhing ſubſtance betweene the excrements and the vrine, and muſt moulder againe into earth and duſt, wherefore in the ruffe of our pride let vs ſeriouſly conſider of that ſaying of *Plinie*, *Alas, how ſottiſhly frantick is he, that imagines himſelfe out of ſo meane and baſe beginnings, to be borne to pride*; but to returne to our hiſtorie. The wombe is placed in the midſt of the neather belly, that the body might be equally ballanced ſaith *Galen*, and for that cauſe the lauer or baſen is larger in women, from whence alſo they haue larger buttockes then men.

Plinie.

Where it groweth.

But as the burthen increaſeth, the wombe in the vpper part which is the bottome, being looſe and at libertie groweth vpward to the nauill [Tab.10.l] and leaneth vpon the ſmall guts, yea and fulfilleth all the place of the flankes when they are neere the time of their deliuerance. Neither then doth it ſo directly keepe the middle place of the belly, but leaneth either to the right hand or to the left, according to the diuerſitie of the ſexe of the infant, although this be not perpetuall. Sometimes there falleth ſome part of the kal between the bladder and the wombe, and there cauſeth barrennes by the compreſſion of the mouth of the wombe as *Hippocrates* conceited and expreſſeth in the 46. Aphoriſme of the fifth ſection. It is knit partly by the very ſubſtance of it, partly by foure ligaments, wherof two are aboue, two below; but the bottome [Tab.8.p] before, behinde and aboue it is adioyned to none of the adherent partes, but is looſe free and and at libertie, that it might better bee diſtended in women with child, and in coition when the deſire of conception is, might more freely moue, now vpward then downeward and open it ſelfe to the end of the yard, whence *Plato* in *Timæo* calleth it ζῶον ἐπιθυμητικὸν, that is, a crauing creature (ſo ſaith *Salomon The barren wombe neuer ſaith it is enough*,) becauſe in the conception it hath a kinde of Animall motion or luſt to be ſatisfied; neither doth it onely moue it ſelfe in the luſt of conception, but alſo it will in a manner deſcend or ariſe vnto any ſweete ſmell and from any thing that is noyſome: which is the reaſon that many women are ſo eaſily offended with the ſmel of muske or other perfumes taken at the noſe, for that the wombe moueth vpward vnto them; and in the fit of the riſing of the mother, we apply burnt feathers and ſuch like noyſome vapours to the noſe to driue the wombe downeward againe, as alſo ſweete and odoriferous ſuffumigations to draw it downeward to the owne naturall ſeate.

A cauſe of barrennes. *Hippocrates.*

The connexion.

The wombe a very creature *Plato.*

Salomon. Prou. 30. 15.

An obſeruation of the vſe of ſweet and ſtinking ſmels for women.

At the ſides it is tyed to the haunch bones by membranous ligaments [Tab.5.oo qq. tab. 10.ik. Tab.9.fig.4.mm] ariſing as *Galen* ſaith in his 4. Book *de vſu partium*, and cap.14. & in the 4.chap. of his Book *de diſſectione vteri*, frō the Muſcles of the loines; but we rather think (ſaith *Bauhine*) from the *Peritonæum*, and may be compared to Bats wings. [tab.9.fig.1 ff] Theſe Ligaments are wouen ſometimes with fleſhy Fibres (whereupon *Veſalius* and *Archangelus* haue named them Muſcles) by whoſe helpe they being diſtributed into either part of it the wombe is held ſtedfaſt. Theſe Ligaments although they bee ſtrong, yet are they ſome-what looſe or laxe and ſofte, ſo that in no part there are found ſo laxe ligaments, the reaſon is, that they might better bee extended with the wombe, and follow it alſo in the motions without dilaceration; for the wombe when it is filled is large and wide, but afterward is contracted into the quantity of a Peare or a halfe-peny purſe.

Of the conditions of the ties of the wombe.

Theſe Ligaments alſo, as *Hippocrates* and *Plato* in *Timæo* haue written, like to Bridles do hold in the wombe, which yet notwithſtanding rideth as a moored Ship in a Tempeſt betweene her Anchors, eſpecially in barren women, ſometimes vpward to the Liuer and Midriffe, and compreſsing them it bringeth a feare of ſuffocation; ſometimes downward, bearing toward the hips, and cauſeth in them great paine, but eſpecially it troubleth the left ſide, whence it is that we obſerue that thoſe women which beare vnprofitable burthens do

The quantity of the wombe Simily.

A good obſeruation for women.

The first Figure sheweth the wombe cut from the body, with the vessels which grow vnto it, the Testicles, the Bladder, and the Membranes: the necke of it is turned vpward, that the orifice of the bottome of the wombe may the better be perceiued; the bladder also is opened, that his cauity, and the insertion of the Vreters may better appeare.

The second Figure sheweth the wombe, with his vessells parted from the Membranes and the bladder.

The third Figure sheweth the womb freed from all the vessels excepting the spermaticall vessels, where also the forme of the Trumpet is omitted.

The fourth Figure sheweth the wombe cut out of the bodye, and thicknesse of his coates in a woman with childe, and the cleft of the lap or priuity dilated or laide open.

TABVLA. IX.

A. The bottome of the wombe laide open without any Membrane.

B B. The necke of the wombe turned vpward.

C D. A part of the bottome of the wombe like the nut of the yard, swelling into the vpper part of the necke of the wombe, in the middle whereof the orifice appeareth.

E E. A Membrane knitting the wombe to the *Peritonæum*, and holding together the vessels thereof.

F. The left testicle.

G. The spermaticall Veine and Artery.

H. A part of the spermaticall vessells reaching vnto the bottome of the wombe.

I. One part of the vessels comming to the Testicle.

* A vessell leading the seede vnto the wombe.

K. The coate of the testicle with the implication of the vessels.

L. The cauity of the bladder opened.

M. The insertion of the Vreters into the bladder.

N. The Vreters cut from the Kidneyes.

O. The insertion of the neck of the bladder into the lap or priuity.

The second Figure.

a a. The spermaticall Veine and Artery.

b b. Branches distributed to the *Peritonæum* from the spermaticall vessels.

c The bottome of the wombe.

d The necke of the wombe.

e Certaine vessels running through the inside of the wombe, and the necke thereof.

ff Vessels reaching to the bottome of the wombe produced from the spermaticall vessell.

g g The Leading vessel of seed called *Tuba* the trumpet.

h h A branch of the spermaticall vessell compassing the trumpet. *i i.* The Testicles.

k k The lower Ligaments of the wombe, which some call the Cremasteres or hanging Muscles of the wombe.

l the lap or priuity into which the cremasteres do end

m A portion of the necke of the bladder.

The third Figure.

a a. The spermaticall vessels.

b b. A branch from these spermaticall vessels to the bottome of the wombe.

c c The bodie or bottome of the wombe.

d The necke of the same.

e The necke of the bladder ending into the necke of the wombe. *f f.* The testicles.

g g The leading vessels, commonly though not so wel called the eiaculatory vessels.

h h The diuision of these vesselles, one of them determining into the hornes at double *k k*.

i i The other branch ending in the necke, by which women with childe auoide their seede.

k k The hornes of the wombe.

The fourth Figure.

A B. The bosome of the bottome of the wombe, at whose sides are the hornes.

C D. A line like a suture or seame, a little distinguishing that bosome.

E E. The substance of the bottome of the wombe, or the thicknesse of his inward coate.

F. A protuberation or swelling of the wombe in the middle of the bosome. G. The Orifice of the bottome of the wombe. H H. The coate or second couer of the bottome of the wombe, comming from the *Peritonæum*. IIII. A portion of the Membranes which tye the womb. KK. the beginning of the necke of the womb. L The necke of the Bladder inserted into the necke of the wombe. *m* the *Cliteris* in the toppe of the priuite. *n* The inequality of the priuity where the *Hymen* is placed *o* the hole or passage of the priuity in the cleft. *p* The skinny caruncle of the priuity.

do especially complaine of greefe, paine, and gnawings in the lefte side, sometimes it beareth more downward, as in lustfull passions, and nowe and then compressing the necke of the bladder, it causeth strangulation.

How the womb mooueth.

But we must vnderstand that the wombe is not like a gadding creature that moueth out of one place into another, relinquishing her proper place, but is onely vnequally extended and againe re-called or drawne backe into it selfe from that extension, as when vppon the retention of the menstruall courses, there groweth a plenitude, and so a distension of the veines and ligaments (for these ligaments as we sayde, haue fleshy fibres, and are therefore some-

ſomewhat muſculous, and ſo ſubiect to ſome diſtention) and if it deſcendeth any thing at all it is but a very little; but when it is drawne vpward to the bottome of the ſtomack, that hapneth by reaſon of the conuulſion of the veſſels, which is ſomtimes from repletion, ſomtimes from inantion; not that the wombe is a liuing creature, or hath voluntary motion, or ariſeth it ſelfe aboue the ſtomacke.

A ſtrange caſe like a poſſeſſion in Mary Glouer of Thames ſtreet

So haue we ſeene in a generall, or by and by after a generall convulſion of the whole body, thoſe veſſels ſo conuelled that the wombe hath preſſed vppon the parts next vnto it, thoſe vpon the midriffe, the midriffe vppon the lungs, the lungs vp euen to the throate; ſo that ſome haue thought the partie to bee poſſeſſed of the foule fiend; ſome that would make themſelues wiſer, and ſhould by right haue had more wit, haue ſayd that the mother roſe into the throate. But *Hippocrates* in his Booke *de articulis*, hit the nayle right when hee ſayed; that the wombe of it ſelfe changeth not much his place, but is drawne by other parts. Yet ſometimes what with the waight of the Infant, what with the difficulty and violence of the birth, the ligaments are ſo relaxed that the bottome of the wombe falleth downeward into the lappe: ſometimes alſo the necke is turned and it hangeth forth of the priuities like a yarde betwixt their thighes, that it muſt be taken away by the Chyrurgion, or fall of it ſelfe when the ligaments are putrified, as we ſhall hereafter haply more particularly declare in our Treatiſe of the accidents of the womb in a work of Chyrurgery, which now gloweth and ſparkleth vpon the anuile.

Hippocrates.

The cutting out of the wombe.

For it is not to be doubted (ſay diuerſe both Greekes and Arabians, beſide ſome experience alſo of our owne times) but that a woman may liue without a wombe, becauſe there is no neceſſity of it for the preſeruation of the particular or indiuiduall nature, but onely for the propagation of the kinde.

The tyes of the neck of the wombe.

The necke of the wombe is tyed to the neighbour parts but not on euery ſide; at the ſides it groweth to certaine membranes, and by their mediation is looſely tyed to the *Peritonæum*; backward it faſtneth to the great or holy-bone, and to the right gut with very thin fibres and a little fat on which it lyeth all along his paſſage, and aboue the lap groweth into one with the fundament to which it is before vnited; ſo that ſometimes when the fundament is vlcerated a little within, the excrements haue been ſeene to fall out at the lappe. Before, it is tyed to the necke of the Bladder. [tab. 8. [t] table 9. fig. 1. [o] fig. 4. [L]] And becauſe the necke of the womb is broader, part of it is tied to the ſharebones by the helpe of membranes ariſing from the *Peritonæum*; hence it is that in inflamations of the womb there followeth a *Teneſmus*, which is a vaine deſire or dolorous offer to the ſtoole, and the ſtrangurie: and ſo much of the vpper ligaments of the wombe.

A good obſeruation for women.

The lower ligaments. *Laurentius.* *Columbus.* *Varolius.*

The lower Ligaments of the wombe [table 8. [oo] tab. 9. figure 2. [K]] of which *Veſalus* maketh no mention, are likewiſe two, which *Laurentius* cals κρεμαστῆρες; *Columbus*, *proceſſus vteri*; *Varolius*, the hornes of the wombe: but indeede they are certaine neruous productions, round like to earth wormes, reddiſh, and hollow eſpecially in their end, like vnto the *husky-membrane*, which cauity is ſometimes found to be filled with fat. Theſe Ligaments proceede on either hand from the ſides of the womb [table 8. at [p] table 9. at [c]] and in their beginning or originall they touch the leading [table 8. [m o] table 9. figure 2. [g]] veſſelles of the ſeede; thence they riſe vnto the leske, and are carried through the production of the *Peritonæum*, as the ſpermaticke veſſelles of men, and paſſe through the Tendons of the oblique muſcles of the *Abdomen*. This production beeing dilated, when alſo the inward coate whereof it conſiſteth is firſt broken as in hard bargaines of trauell it often hapneth, there falleth to Women as to Men a rupture of which they are cured by Ligature after ſection.

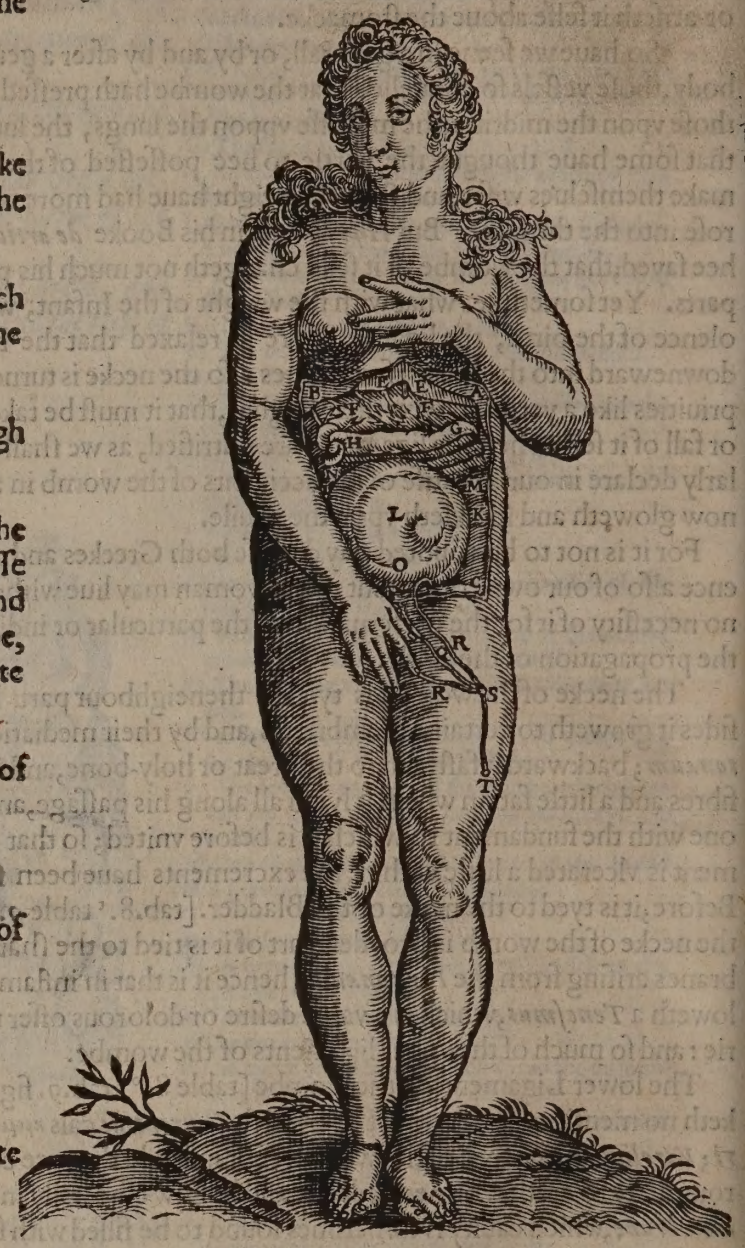
The rupture in women how cauſed.

To theſe after they are out of the *Abdomen*, are ioyned fleſhy fibres comming from the hanch-bones, which make certaine ſmall muſcles called κρεμαστῆρες, in Latine *ſuſpenſores* that is *hangers vp*, of which *Veſalius* maketh no mention. Theſe in women haue no communion with the Teſticles, albeit in men they haue, becauſe they adioyne to the ſpermaticall veſſels.

Theſe Ligaments aboue the ſhare-bone [table 9. figure 2. [l]] do degenerate into a broad and ſinewy ſlendernes (mingled as it were with a membrane which toucheth and inueſteth the fore-part of the ſhare-bone) vppon which the *Clitoris* cleaueth and is tyed; in ſo much that being neruous and therefore of moſt exquiſite ſence, from his attrition luſtfull imaginations are communicated to theſe Ligaments, and from theſe to the veſſelles leading the ſeede: although their vſe alſo is, to hold the wombe ſuſpended leaſt it fall out of the lappe

(like

Table x. sheweth the portrature of a woman great with child whose wombe is bared and the Kel taken away, that the stomacke, the guttes and the wombe might bee better seene. TABVLA. X.



A, B, C. The inner part of the *Peritonæum.*

E E. The embowed part of the Liuer.

F F. The Stomacke.

G, H. That part of the Collicke gut which runneth vnder the stomacke.

I, K. The Membranes by which the wombe adhereth to the bones.

L. The womb ascending as high as to the Nauell.

M, N. Coates arising from the *Peritonæum*, which compasse the Testicles, the vessels and the forepart of the vvombe, and make the outward coate of the same.

O. The fore-part of the necke of the wombe.

P. The place of the bladder.

Q. The *Vrachus*, a Ligament of the bladder.

R R. The vmbilicall arteries.

S. The Nauell.

T. The vmbilicall veyne cutte from the Liuer.

The Vses of the ligaments

(like as the *Cremasteres* in men doe suspend the Testicles) to strengthen and corroborate it, as well becausе of the great burthens it carries often and long, as of the strong throwes in the birth, and the humours which doe flow thither out of the whole body, which doe not onely moysten the part, but also might very well relaxe it. Finally by how much these Ligaments haue more fleshy fibres wouen into them, by so much do they sayth *Pinæus* more leane to the office of muscles, helping the voluntary attraction of mans seede out of the necke into the cauity of the wombe.

The Figure of the wombe.

The figure of the wombe is round [table 8. P tab. 9. figure 1. ^ figure 2. c] that it might bee the more capacious, and lesse obnoxious to iniuries; aboue, it is somewhat depressed [table 9. figure 3.] like the bladder, excepting the tops of it which they call the hornes. For in woemen with child, as in the bladder so in the womb, the bottome is long and the necke narrow; but in those that be not with childe the bottome is no broader then the necke. *Soranus* and out of him *Falopius* likneth it to a pressed cupping glasse, both for the forme and also for the manner of attraction; for the seed of man cannot attaine vnto the bottome of the wombe vnlesse it be drawne. Taking it together with the necke it is very well compared by *Archangelus*, *Laurentius*, *Pinæus*, and *Bauhine* to a Peare. [table 9. fig. 3.] For the bottome downward directly from the corners becommeth narrower by degrees euen to the beginning of the necke, which is like a long and round passage, yet so as that the bottome

Like a Peare.

Archang. Laur. Pinæus.

is

is of a figure moſt like vnto roundnes as wee ſee in a good fayre Peare, whoſe bottome is round and bottle faſhion.

The magnitude of it is not in all women alike, but differs according to the age, body, and impregnation or burthen. In Virgins that are growing it is ſmall and leſſe then the Bladder; but in women growne it is greater; ſo in thoſe that vſe not mans helpe, and in old women becauſe they are dryed and withered, it is but little, (that it may the leſſe trouble the neighbour parts) and thicke, not much broader then two fingers; and in length ſcarce euer ſo long as three (I meane the bottome,) ſeldome reaching aboue the ſhare-bone and the bladder. In ful growne women it is greater, (yet thoſe that haue neuer conceiued are much like to virgins) becauſe there is preſent vſe of it; and after a woman hath bred in it, it remaineth during the ſtrength and ability of their age ſomewhat larger then when ſhee was a growne Maide, yet not aboue a handfull. In a woman with child it is increaſed into all dimenſions, for the larger it is ſtretched the thicker it groweth. It hath two ſorts of parts, ſimple, and compound.

Table 11. *the firſt figure ſheweth the wombe of a woman with childe opened in the length, that the after birth cleauing thereto might be ſeene.*

The 2. *figure ſheweth the after birth ſeparated from the wombe.*

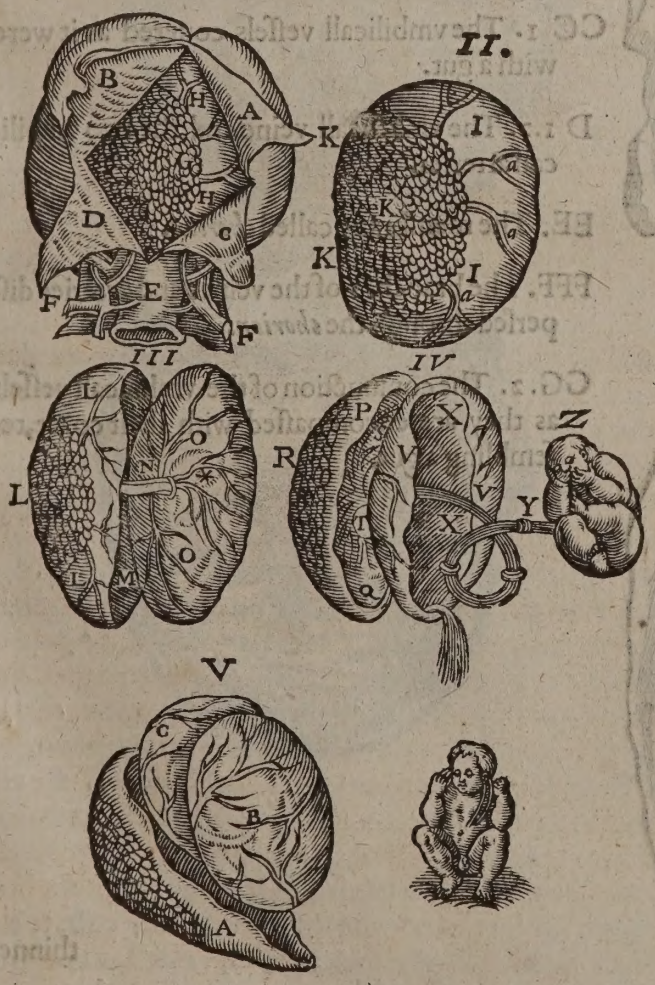
The 3. *the coate wherein the vrine of the Infant is receiued.*

The 4. *figure ſheweth the Allantoides and the Amnion opened, with the naturall ſcite of the Infant according to the common receiued opinion of Anatomiſts.*

The 5. *figure ſheweth the coates or couerings of the Infant according to Veſalius, eſpecially the membranous bladder which receiueth the vrine of the Infant.*

TABVLA XI.

FIG. I



ABCD. The back part of the womb cut into foure parts. *Fig.* 1.

E. *A* part of the necke of the womb.

FF. Veines and arteries compaſſing the neck of the wombe.

G. *A* certaine fleſhy ſubſtance growing to the outward coate, called the cake or the liuer of the womb, becauſe of his manifold veſſelles. This miniſtreth bloud vnto the Infant by the nauill.

H H. The outward couering of the Infant in the wombe which they call *Allantoides.*

a a. 2. The diſtribution of the veſſels. *Fig.* 2. 3. 4.

KK 2. The fleſhy cake of the after-birth.

LLL 3. The outward coate of the Infant opned, to the backſide wherof cleaueth the afterbirth which ſome thinke is the *Allantoides.*

M 3. The inſide of this outward coat

N 3. Veſſelles produced out of the cake or liuer of the womb, making the nauill of the Infant.

* The inſertion of the veſſels which make the nauill.

OO 3. The inner coate of the Infant yet whole, which they call *Amnion*

P 4. The outſide of the *Allantoides.*

Q 4. The inſide of the ſame.

R 4. The cake, liuer, or after-birth.

ST 4. The veſſels ioyning into one at T.

VV 4. The outſide of the *Amnion.*

XX 4. The inſide of the ſame.

Y 4. The vmbilicall veſſels inſerted into the nauill of the Infant.

Z 4. The Infant as it ſitteth doubled in the wombe.

A. The outward coate of the Infant cut length wiſe. *Fig.* 5.

B. The inner coate or *Amnion* yet whole.

C. *A* ſoft and thin membrane like a bladder, leading out the vrine thorough the nauill; this keepeth the vrine of the Infant whileſt it is in the wombe.

The

The compoſition of the wombe. The ſimilar parts of it. Membranes.

The ſimple parts are the Ligaments of which we haue ſpoken; membranes, veines, arteries and nerues, of all which the wombe is compounded. The compound parts are foure, the bottome, the mouth, the necke, and the lap or outward priuitie. The membranes are two, one outward another inward, whoſe nature and property it is to be able to be extended or ſtreatched, and againe contracted and gathered together. The vtter [table 9. figure 4.[HH] table 5.[oo qq]] which is called the common membrane and is neruous, is the thickeſt of all membranes that come from the *Peritoneum*: wherefore it is ſtrong and growes to the wombe on both ſides and is doubled, inueſting it for more ſafety and ſtrength. The inner [Table 9. Figure 4.[EE] Table 11. Figure 1.[ABCD]] or proper is double, but yet ſo ioyned that they can hardly bee diſtinguiſhed but in exulcerations; betweene which as betweene the coates of the ſtomacke there are placed fleſhy fibres; which they that ſay the wombe hath but one coate, doe not call a coate but the very ſubſtance of the wombe, when indeed both theſe and the outward make the ſubſtance of it together membranous, thight, & compact; that when the burthen is encreaſed they may bee dilated, and after the birth may bee contracted again; but by reaſon of this inner or proper membrane it is fleſhy or very thick that it might haue heat to cheriſh the ſeede and the Infant; and beſide it is porous, that it may be extended according to the increaſing of the burthen. Wherefore it exceedeth in thicknes all other coates of the belly, neither doth it alwayes keepe the ſame thicknes ſayth *Galen* in the 8. Chapter of his Book *de diſſectione vteri*: for in youth it is ſmall and alſo the

The duplication of the inner membrane.

What is the ſubſtance of the wombe.

How it increaſeth or decreaſeth in thicknes.

Table 12. wherein the after-birth together with the vmbilicall veſſelles are exhibited.

TABVLA XII.

FIG. I.

FIG. II.

AAAA 1. The fleſhy cake or liuer of the wombe made to ſtrengthen the veſſell.

BBB 1.2. The membrane called *Amnios*.

CC 1. The vmbilicall veſſels couered as it were with a gut.

D 1.2. The vmbilicall veine and the two vmbilicall arteries.

EE. The membrane called *chorion*.

FFF. The branches of the veines and arteries diſperſed through the *chorion*.

GG. 2. The coniunction of the vmbilicall veſſels as they are encompaſſed with their coate, reſembling a gut.

thinner

thinner, but after the courſes begin it growes in thickneſſe as in magnitude, as alſo it decreaſeth both in magnitude and thickneſſes when Women leaue to conceyue and theyr courſes ſtay. For the beginning and end of their courſes is, when they begin and ceaſe to be fit for conception. So when the time of the courſes is at hande, it growes thick and ſomwhat tumified, as being watered or dewed with the humidity of the bloode which floweth vnto it. Againe, the oftner a woman hath conceiued the thicker it is.

Moreouer, in the time of conception it is thicke and ſofter and growes thicker as the conception encreaſeth, beeing thickeſt of all at the time of the birth. Yet *Galen* ſeemeth to ſay otherwiſe in his Booke *de diſſectione vteri*, and the 8. chapter, and the 14. Booke of the vſe of parts, and the 14. chapter (which opinion of his many follow) albeit it is againſt himſelfe a little before where hee ſayth, that it groweth thicke when the courſes come becauſe of blood; now we know that the greater the infant growes, the more bloode accrueth vnto the wombe.

And indeed by Diſſection we are taught, that about the time of deliuerance, and in the laſt

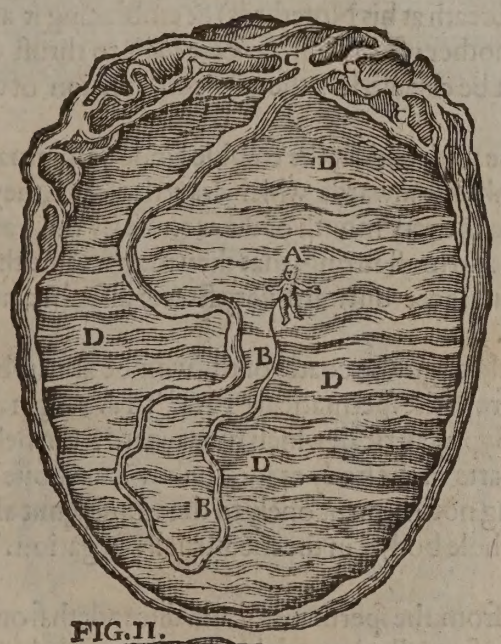


FIG. II.

The firſt Figure ſheweth an Infant of 14. dayes olde, in which all the parts are exactly delineated.

A. The Infant.

B B. The vmbilicall veſſels meeting together.

C C. The diuarication of the vmbilicall Veſſelles, thorough the Chorion.

D D D. The Coate called *Amnios*.

The ſecond figure ſheweth an abortiue Infant, which was auoided the xxv. day after conception, being deprined of blood to nouriſh it, becauſe the vmbilical veſſels were broken. The magnitude of that infant is perfectly deſcribed.

month it becommeth two Fingers bredths thicke, and that not onely in one place but euery where, eſpecially toward the higher part of the bottome or ſoale in which the veſſels of the wombe did meete, and to which the after byrth called the *ſecundinæ* doe adhere; for as we ſaide before after the conception it encreaſeth in all kinds of dimenſions til it be vnburdened. For from the plentifull confluence of blood, becauſe of the many veines and Arteries ſcatterly diſperſed through his coates, his ſubſtance becomes fleſhy, fungous, ſpongy, and diuiſible into many ſhels or huskes like a Bezoar ſtone, or after the manner of muſhrumme, that it might containe the greater quantity of blood and ſpirits or the life and nouriſhment of the Infant, and beſide the heate beeing encreaſed it neceſſarily draweth more vnto it, and ſo it tumifieth and is diſtended, but after the byrth when the confluence ceaſeth, it returneth to his former both magnitude and thickneſſe. For if it neuer gathereth that carnoſity and ſoftneſſe the woman neuer conceyueth. But if it ſometimes do not gather it, then is ſhe for that time fruitleſſe, whence it is that we ſee ſome women which haue conceyued to become fruitleſſe for a ſpace, and after fall to bearing afreſh.

Why women who haue conceiued leaue bearing for a time, & after fall to it againe.

The Fibres of the wombe.

Betweene theſe membranes run Fibres (ſaith *Galen* in his 14. Booke *de vſu partium*, and the 14. chapter) of all ſorts, becauſe it muſt draw and reteine the ſeede and expell the burthen; the fleſhy fibres make the proper *parenchyma* or fleſh of the womb; that ſo the heate may be encreaſed for conception: by which alſo it may be, as by muſcles the voluntary motion of the wombe in drawing the ſeede into his cauity (as a Hart draweth a Snake out of the holes of the earth by drawing in his breath at his Noſethrils) & embracing it afterward is accompliſhed; haply alſo they haue another vſe (ſaieth *Archangelus*) to thruſt out ſome recrements of the wombe, which cannot be cleanſed by the ſole compreſsion of the Muſcles of the *Abdomen*.

Comparison.

Archangelus.

The ſpermaticall fibres of the wombe.

But in thoſe that are ſomewhat gone with childe, the trebble kinde of ſpermaticall Fibres do appeare more manifeſtly, the right are inwarde which draw the ſeede, they are but few becauſe the ſeede is brought euen to the very mouth of the wombe by the yard. The oblique are in the middeſt and are moſt and moſt ſtrong, that they may retaine that which is conceiued till the due time; the tranſuerſe are outward very ſtrong alſo, becauſe of the force that is neceſſary in the deliuerance.

The Veynes & arteries of the wombe.

The veines and arteries which paſſe through the coates of the wombe are twofold, for two veins & two arteries are led thither from the ſpermatical [Ta. 8.[ll]. Ta. 9. fig. 1.[n] fig. 2[ff]. fig. 3.[bb]] veſſels, ſo many alſo from the Hypogaſtrical, which run vpward from below; [tab. 9. fig. 2, [c]. Tab. 11. fig. 1, [FF]] that from all parts of the body as well below it as aboue it, blood might be miniſtred vnto it; for they bring not Aliment onely to the wombe, but alſo to the infant, as alſo they ſerue to emptie the whole bodye in the menſtruall purgation. But the the veines are greater then the arteries.

The veine frō the ſpermaticall.

The one of theſe which proceedeth from the ſpermaticall and diſcendeth from aboue, is diſſeminated through his whole bodie eſpecially through his bottome, to bring aliment vnto it, yet the ends of the veſſels which are carried into the left ſide are vnited & become one with the ends of the veſſels which are diſtributed in his right ſide, that ſo the right ſide (for this is *Galens* opinion, in his 14. Booke *de vſu partium*, and the 9. Chapter) may take to it ſelfe ſome ſmall portion of whaey humidity, which may by his acrimony ſtirre vp his action and procure pleaſure; as we ſee the whaey humors that are gathered vnder the skinne if they be heated, they ſtirre vp itching and a kinde of pleaſure withall. By this veine alſo the chiefe part of the menſtruall blood, eſpecially in women but not with childe, dooth flowe foorth.

Galen.

A cauſe of pleaſure.

The Veine from the Hypogaſtricall.

The other Veine ariſeth from the Hypogaſtricall braunch of the hollowe Veine at the ſides of the great bone about the ſhare; it is the greater and aſcendeth by the ſides of the necke vnto the middeſt of the wombe, where it mingleth it ſelfe with the former. This is diſtributed partly through the bottome of the wombe, partly through the necke of it. But the veſſels that paſſe through the bottome, are alwayes vnited (which ſaith *Fallopius*, Anatomiſts haue much neglected) by ſome branches, and that eyther without the wombe or in his ſubſtance: without the wombe, the boughs of the vpper vein are ioyned with the ſmall branches of the lower at the necke of the womb [Tab. 9. fig. 2, [c], with [h]] where on both ſides there are many veſſelles, and thoſe notable ones finger-fanged or placed like croſſe Fingers, and being vnited doe paſſe into his ſubſtance and end or open into the cauity, which Anaſtomoſes or inoculations of veines are more conſpicuous in women with childe, and thoſe whoſe courſes do flowe or are neere vpon it. But if they be not vnited, then from the

lower

lower veine some branches are carried vpward, to be planted in the bottome.

The branches of this Hypogastricall veine being entred the substance of the wombe do mingle themselues with the vpper braunches proceeding from the spermaticall; and the mouths or extreamities of them reach vnto the inner cauity of it, and are called *Cotelydones* and *Acetabula*, to which in the conception the Liuer of the wombe or the after birth doth cleaue, from whence the infant receiueth aliment through the vmbilicall vesselles, and by which it is tied to the wombe. Through these, there arriueth more blood at the wombe then is necessary for the nourishment thereof all the while the Woman is childing, that when conception shall happen to bee, there may bee some quantity of the Mothers blood at hand which is one of the principles of generation; as also that when the infant is begotten and doth encrease, it may not want aliment according to that proportion it standeth in neede of; all which blood after the infant is brought into the world, returneth back to the breasts and there is turned into milke.

Acetabula and *Cotelydones* what they are

At other times, because it is more plentifull then the womb it selfe requireth, therefore it is like a superfluity excluded euery month, and if it bee reteined it will corrupt and induceth many passions called *Hystericæ*, which we call fits of the Mother, which yet are oftner procured by seed reteined and corrupted then by blood. With this blood also other excrements conteined in or amongst the blood and a whole heape of humors are purged sometimes in three dayes space, sometimes they flow longer, and commonly at the new moone the younger sort haue them, the elder in the full of the moone; which therefore wee note, because when in Maidens the courses are stopped and they know not well when the time of their euacuation should be, we should apply our remedies either in the end of the olde

The menstruall purgation.

An obseruation for the procuring of the courses

TABVLA XIII.

FIG. II.

The first Figure sheweth an Infant of 14. dayes olde, in which all the parts are exactly delineated.

A. The Infant.

B B. The vmbilicall vessels meeting together.

C C. The diuarication of the vmbilicall Vesselles, thorough the Chorion.

D D D. The Coate called *Amnios*.

The second figure sheweth an abortiue Infant, which was auoided the xxv. day after conception, being depriued of blood to nourish it, because the vmbilical vessels were broken. The magnitude of that infant is perfectly described.

Moone, or in the beginning of the new.

The other part of the *Hipogastrical* veine.

Finally, the other part of the lower veine is inserted into the necke of the wombe, [Tab. 9. fig. 2, ᶜ] whether if too much blood be brought by the spermaticke vessels whilst the woman is with childe, it is exonerated not by the orifice or mouth of the wombe, but by the Anastomosis or inoculations of the veines into the neck of the same. Wherefore by these veines are some women with childe euacuated which haue plethoricall and ful bodies and so more affluence of blood in the first months after their conception then is required for the nourishment of the Infant, and not by the bottome of the wombe as otherwise in maides and women the menstruall blood vseth to bee purged; otherwise the Infant would be choaked with the aboundance of bloud and the orifice of the wombe must necessarily be opened, which would bring a danger of abortment.

How and by what wayes women with child haue their courses.

Of the arteries of the wombe. Their vse.

That which we haue sayed of the veines wee must say of the arteries which accompany them, whose vse also is in those that be not with childe to encrease the heat of the womb, to bring vnto it spirit and vital bloud, together with vital faculty and heat, and by their motion to ventilate or breath the in-bred heat, to stir the bloud and so to preserue it from putrifaction. But whether in the time of the courses the arteriall blood bee also euacuated, we ingenuously confesse our selues to be ignorāt saith *Bauhine*, sure we are that from these forenamed vesselles or that which is called the lap or priuy veine, there are carried certaine small veines and arteries to the lap and the hillocks or Caruncles thereof.

The nerues of the wombe.

The nerues of the wombe though they bee small yet are they very many, implicated or couched one within another like a net, that they may confer exquisite sence vnto it. To the higher part of the bottom of it, they come from the termination of the branches of the sixt coniugation which go vnto the roots of the ribs. To the lower part of the bottom and to the neck, from the marrow of the loyns and the great bone, (whence is that admirable consent between the womb and the head especially the backpart of it) that feeling those things that are troublesome, the expelling faculty might be prouoked, and pleasure also conceiued in coition, (therefore about the lower parts they are more plentifull) as also the motion of the wombe wherein it draweth and imbraceth the seed of the man quickned and strengthned. For there are certaine fleshy fibres in the wombe as wee haue shewed already, which are in stead of small muscles. And thus far of the simple and similar parts of the wombe or matrix, now followeth the compound or dissimilar.

The cause of the consent betweene the wombe & the head

A cause of pleasure.

CHAP. XIIII. *Of the simple or similar parts of the wombe, and particularly of the bottome and the orifice.*

The parts of the wombe.

ALthough from the bottome of the wombe to the very lap or priuities there be but one continuated passage, yet because in it there are many and diuerse parts, therefore it is diuided into the vpper part or the bottom, the mouth or inward orifice of the necke, the necke it selfe and the outward priuity or lap.

The bottome or soale.

The bottom which is properly the wombe & the matrix, *Hippoc.* in his booke *de nat. pueri* calleth κόλπος, *sinus* the bosom. *Galen* so also *lib.* 14 & 15. *de vsu partiū* & the 3. chapters, and somtimes κύτος, that is a cauity or hollownes. This is the chiefe of all the parts of it, because for it al the other parts were made; for in it is the Infant conceiued of the seed, (that we may so say according to our manner of speech, though indeede conception is nothing els but the wombs receiuing and imbracing of the seede) formed and distinguished, nourished & increased, made a liuing soule, & preserued euen to the infusion of that diuine & immortal substāce, & thē it thrusteth it into the sea of the world & the tides of the same.

This bottome then is the vpper [tab. 5.ᴸ tab. 8.ᴾ tab. 9. fig. 1.ᴬ fig. 2. & 3.ᶜ sheweth the bottom of the wombe of a woman with child cut open] and broader part of the womb placed aboue the share-bone, that so it might better be dilated as the Infant increaseth; on the out side smooth, equall and lined ouer as it were with a wateriſh moysture and sendeth out on either side aboue a certaine production or rather a corner, which *Herophilus* compareth to the turning of a halfe moone; *Diocles* and with him *Galen* in *lib.* 2. *de dissectione vteri*, chap. 2. and chap. 8. and *lib* 14. *of the vse of parts* chap. 11. calleth them κεραίας, that is hornes, because the superficies of the wombe is there somewhat more eminent, euen as in the heades of young calues there are certaine buds where the hornes vvill afterwards grovv forth. Into these the seed of the vvoman is povvred out in those that be not vvith child, for into thē the leading vessels of seed are inserted. [tab. 9. fig. 1.* fig. 2.ᵍᵍ fig. 3.ʰʰ] These you may plainly see if you cut the bottome of the vvombe through the midst; for on the inside at the orifice [tab. 9. fig. 4.ᶜ] you shall perceiue on each side a little corner [tab. 9. fig. 4. at ᴬ & ᴮ] vvhich by degrees [tab. 9. fig. 4.ᴬᴮ] inlargeth it selfe tovvard the bottome.

The hornes.

The

The vse of these hornes is, that the wombe might be made more capacious for the entertayning of the Infant, because vpon these two stocks as vpon bases may two vesselles of Infants bee built or generated. Their vse.

Wherefore because it is the instrument of conception it hath a cauity & yet but one, for there are in it no partitions or chambers: notwithstanding it is vsually diuided into the right and the left bosome; the right in which male childeren are conceiued, the left in which females are conceiued, as *Hippocrates* and *Galen* haue determined: yet is not this diuision made by any wall or partition, but onely by a line or future and seame [tab. 9. fig. 4. $^{C\ D}$] lightly rising vp but very obscurely through the middle part of the superficies, and running forward & backward according to his longitude; which line or future is called by *Aristotle* in the 3. Booke of his History of Creatures and the first Chapter σπορὰν the *mediana* or the middle: and thence it is that the antients doe not call it matrix but *matrices*, or the mothers, as if there were two of them, and sayed they were answerable in number to the breastes, for it is a very rare thing that a womans wombe should be diuided into two as beasts are. The cauity of the wombe. The future or line.

This cauity [tab. 9. fig. 4. $^{A\ B}$] is smooth and so narrow that it will scarcely hold a common beane, and when it receiueth the seede from both the Parents it is filled with it, for any portion of seede that getteth into it filleth it, because it embraceth it so narrowly; for in the least portion of seede that may be, the whole formatiue faculty is potentially included, out of which mingled and as it were fermentated and houed vp, the Infant is generated; and is encreased by blood eftsoons comming to it for nourishment, by which also the substance of the wombe groweth into a greater bulke; as a little sponge if it be filled with water will arise to a greater magnitude, which being pressed out againe the sponge will become as small as before. The least quantity of seed filleth the wõbe. A fit comparison.

The bottome hath many pores or passages which are the mouthes of the *Cotelydones* so called, by which the bloud in the time of gestation reacheth out of the veines of the wombe into his cauity. In women not burdened for the most part it is lined within with a viscous or slimy substance whitish or of colour betweene a pale yellow and a red. The substance of the bottome of the wombe is harder and more compact then that of the lap, yet softer then that of the necke, and in the corners it is rugous. The way of the bloud for the nourishment of the Infant.

From the lower part of the bottom there runneth a notable portion resembling the nut of the yarde [table 9. figure 1. $^{C\ D}$] which with his blunt head toucheth not the sides of the neck, about an inch long, but as slender as a little finger, that it will scarcely admit a Probe or a small penne at the most: but it is rough least the seede that is drawne should fall back, which commeth to passe in those women who haue this part slippery because their humors are faulty, and so become barren. This part which is betweene the beginning of the bottome and the orifice, *Falopius* thinks was called the necke by *Galen*, *Soranus*, and the antients. It hath a manifest passage [table 9. fig. 1. betweene ^{c} and ^{D}] which maketh also another part. A secret part wanting a name. *Falopius* his conceit of the name of it.

This passage is the entrance into the bottome of the wombe, wherefore *Hippocrates* in the first section of his Aphorismes, and the 51. Aphorisme calleth it στόμα τῶν ὑστέων, *vel* τῶν μητρέων, *os vteri* the mouth of the wombe: *Galen* in his 14. Booke *de vsu partium* and the third Chapter, and in the 7. Chapter of his Booke *de dissectione vteri*, calleth it the inwarde orifice of the necke, for by this the bottome openeth directly into the necke. The orifice or mouth of the wombe.

This orifice is transuerse or ouerthwart like a Plaice mouth, or most like to the passage in the nutte of the yarde: so that the whole orifice with the transuerse flitte, is like the letter, Θ, smal and wondrous narrow, that the seede once receiued cannot easily fall backe, nor any thing hurtfull get into the cauity of the vvombe. It is direct against the bottome, because the mans seede might passe in a right line through the necke and it to the bottome; and so also it might be better drawn by the bottom from a leuel, for if it be diuerted or turned aside may euils follovv sayeth *Hippocrates* in his first Booke of the diseases of vvomen, for then the vvombe receiueth not the seede, but it falleth backe againe out of the neck instantly. The fashion of it.

Then also the courses either come not at all, or with great violence and disease: it is alwayes shut except only at that time, when in coition the bottome draweth the mans seed, and when the feed is conceiued or receiued then is it so closely shut vp saith *Hippocrates* in the 51. Aphorisme of the 5. Section, that a Needle or a small Probe can hardly be thrust into it: and so it continues nine moneths; for when women with childe yeelde seede it is not out of the bottome but by the necke of the vvombe, as vve haue sayd before. The closenes of it.

Verie rarely is it opened, and that either for the casting out of a false conception a perfect conception remaining behinde, or in superfœtation where after one conception another By how many meanes it is opened.

other commeth. So likewise, when the wombe not fit to conceiue doth belch out againe the seed of both parties, or when as in polutions or affrictions women that haue not conceiued do loose their owne seed; or when as in women vnburdened the courses or any offensiue humors are that way purged, as in the Whites, in which case oftentimes the whole bodie is purged that way, the wombe at all not beeing affected; or when false conceptions alone are cast out, as the *Mola* or Moone-calfe, and such like; or finally, when the Infant it selfe is borne into the world; for when that is perfected, this passage is so distended & openeth so wide, that from the bottome of the wombe to the very lap the cauity is equall, that through it the Infant may passe; which admirable worke of Nature or Natures Mayster God himselfe, we may wonder at, but not vnderstand saith *Galen* in his 15. Booke *De vsu partium*, and the 17. chapter. But because it must be opened according to the magnitude of the Infant, and that by degrees, being it is of a thicke and fast substance [Tab. 9. fig. 4. at q] and is yet thicker when the birth approacheth, there cleaueth vnto it a certain viscid and slimy body like glew, that by the helpe of it the orifice without feare of dilaceration or divulsion may bee distended and naturally opened. This is round like a crowne, and as often as the passage openeth, commeth away in an orbicular forme. The Midwiues call it the Crowne or the Rose. This Orifice, if it be too much loosened or opened aboue measure, as in ouer-moyst bodies, or in the whites, or by reason of too frequent copulation as in Harlots, it bringeth barrennesse; so doth it also if it be too fat, or thicke, or growe callous or hard; sometimes there growe in it the Scirrhus or the Cancer both incureable diseases, which happen especially when the courses faile.

Note this.

The admirable worke of God in the birth.

The crowne or rose of the wombe.

Why Harlots do not conceiue.

CHAP. XV. *Of the necke of the wombe & of the Hymen.*

THE third part of the wombe is the neck called *Ceruix* or *Collum vteri* [tab. 9. fig. 2. and 3, d. Fig. 4. kk], in the first figure the necke is turned vpward at ββ] into which the yard passeth. This *Galen* commonly calleth αὐχὴν τῆς μητρᾶς, sometime ῥάχηλον and στόμαχος. *Aristotle* μῆτρα, καυλὸς καὶ στόμα τῆς ὑστέρας, the matrixe, the necke, and the gate of the wombe. It is a passage within the Cauity of the *Peritonæum*, called the Bason or Lauer, placed betweene the right gut & the bladder, whiter then the superficies of the bottome. It hath a deepe cauity and wide, (whence *Fallopius* calleth it the bosome of modesty) but the mouth or entrance of it is much narrower. It reacheth from the inner [Tab. 5. fig. 4. o] orifice of the wombe, to the outward Orifice [Tab. 9. fig. 4. o] or very lap and priuity, and being long that the seede of the man may be brought to the orifice of the wombe it receyueth the yard fitly like a sheath, wherefore the amplitude is answerable to that it must contain & is not broader then the right gut. It becommeth in the time of coition longer or shorter wider or narrower as the yard is; and according to the womans appetite more or lesse turgid, more open or more contracted & direct; wherefore the length of it cannot be limited no more then the length of the yarde; and though it be continuated with the bottome, yet it hath a diuers substance from it. For it is Membranous and Neruous, that it may better be enlarged or contracted, neither too hard, nor too soft.

The necke of the wombe. 14. *vsu part.* 3. 15 *vsu part.* 3. 14. *vsu part.* 4. *Lib.* 7. *Hist.* 1.

The capacitie of it.

The substãce.

The streightnesse whence caused.

The foulds of it.

The substance of it is somewhat fungous or spongie, like that of a mans yarde, for as it was necessary that the yard should bee distended to fill this, so it was necessary that this in coition should be so contracted and straightned that it might straightly embrace the same, which happeneth by reason of many small Arteries which fill the passage with spirits, & so it becommeth narrower. Wherefore in women that are full of lust, or in the time of anie womans appetite it strutteth, and the Caruncles swell outward (which in Cowes and Bitches is so apparent, that their priuities seeme to bee very much enflamed) and the Cauitie growes very straight. In yong wenches it is more delicate and soft, and becommeth euerie day harder, so that those that haue often conceiued and old women, haue it hard callous & as it were gristly, by reason of the often attrition and the frequent flowing of their courses. Whereupon *Herophylus* compared it to the weazon or winde-pipe. This when it is not distended is rugous, if it be much stretched it becommeth smooth and slippery, vnlesse it be in that part which endeth in the lap; but in the entrance of the passage and in the forepart, there are many round folds for the greater pleasure of louers which commeth from the attrition of them by the nut of the yard. These folds are in yong women smoother and narrower, and the passage straighter, that it will scarse admit a finger, which is not from the cloasing of the sides of his necke, but by reason of the mediocrity of his passage, yet thorough it

do

doe passe not onely the bloud in the monthly euacuations of growne Maydens, but also other corrupt humors in the disease of the whites or womens fluxe, which also we haue seen (being taught by *Aristotle* to obserue it) to bee purged this way in young children of foure or fiue yeare old. A strange obseruation.

The attrition of these folds and their extension in the first society of mayds with men, *Soranus* thought to bee the cause of some maydens payne in deuirgination or losse of their maiden-head as we speake, and because certaine veines passe by them these being broken by the husband the blood issueth sometimes in great aboundance: but the neck (when neither the seed is sent in, nor the Infant is excluded, but at other times) is writhen & oblique; for being loosned and falling into it selfe, it is necessary that it must haue certaine contorsions or wrethings, that the partes within contained may bee defended from outward cold; wherefore then it is shorter and narrower, but in coition it is distended vnto the measure of the yarde; in the birth to the measure of the Infant which are to passe through it: and therefore when the courses flowe, but especially when the time of deliuerance is at hand, the necke becomming right, straight and open, women are most subiect to take colde by it. The cause of paine in deflowring of a mayde. Whē women take most cold.

In the end of this necke, immediatly aboue the necke [table 9. figure 2. [m] figure 3. [c] fig. 4. [r]] of the bladder, they place in Virgins the *Hymen* or *Eugion*, [table 9. figure 4. [n]] which many will haue to bee a slender membrane, neruous, not thicke, placed ouerthwart that it may shut the cauity of the necke of the wombe, yet perforated in the middest like a ring, that in growne mayds it will admit the top of a little finger, that through it the courses may passe, sprinkled also with veines. This they say is broken in the devirgination, from whence comes the paine and effusion of blood, and after it vanisheth as doth the bridle of the nut of a mans yarde: with this also are the wings or lips of the lap tyed together, because there is no vse of a large entrance before coition. The Hymen.

But let vs set downe with your patience, the true History of the *Hymen*, which *Seuerinus Pinæus* the French Kings Chyrurgion hath diligently and at large recorded. A discourse of the Hymen out of *Pinæus*.

In the middle of the trench which is in the great slit or clift lyeth alwayes hid the orifice of the Maidens bosome of modesty, being placed not in the end of the trench, but in the inner end of that production which is annexed to the trench. This production which is peculiar to Virgins, is as long as the little finger is broad in the middest, and is incircled aboue with a round cauity. The figure of it is round, yet determineth into a sharpnes, and in the end hath one notable passage which will admit the top of the little finger.

The substance is partly fleshy partly membranous, being compounded of Caruncles or little peeces of flesh and membranes. The Caruncles are foure, and are like the berries of the Mirtle, in euery corner of the bosome one; the membranes tying them together are also foure, which are not disposed ouerthwart but runne all right downward from the inner end of the sayed bosome, and are placed each in the distances betweene euery Caruncle; with which they are almost equally extended or streatched forth. But these both Caruncles and membranes are in some bodies shorter or longer, thicker or thinner thē in others, as also the orifice at the end of them is in some wider in some narrower, and then especially is at the straighteste when the Caruncles and the fleshy membranes are neareste ioined together, from whence comes either geater or lesse payne in devirgination or deflowring, which *Terence* calleth *The sharpe coition*. The Caruncles. Whence commeth the paine in deuirgination.

All these particles together make the forme of the cup of a little rose halfe blowne when the bearded leaues are taken away. Or this production with the lappe or priuity may be likened to the great Cloue Gilly-flower when it is moderately blowne. *Galen* in the 2. Chapter of his Booke *de vteri dissectione* likneth this production to the prepuce or fore-skin of a man, because it is somewhat long and perforated in the end; yet is it a little more fleshy and softer then the fore-skin. It is called *Hymen quasi Limen*, as it were the entrance, the piller, or locke, or flower of virginity. For being whole it is the onely sure note of vnsteyned virginity (yet some also haue other quaint deuices to try virginity with; as if a thred measured from the tip of the nose along the fore-heade to the end of the sagitall suture or seame, will also fitly encompasse the womans necke,) for when the yarde entreth into the necke of the wombe, then the fleshy membranes which are among the caruncles, are torn vp euen to their rootes, and the Caruncles are so fretted and streatched, that a man would beleeue they were neuer ioyned; some notable vessels are opened, and in the breaking is payne, which in young wenches is more because of the dryenesse of the part, but the effusi- *Hymen.* An od trick to try a mayd. The true cause of paine in deuirgination.

on

on of blood the leſſe, becauſe of the ſmalneſſe of the veſſels. In elder maids whoſe courſes haue now ſome good time flowed there is leſſe paine, becauſe of the moyſture and laxitie of the Hymen; but the effuſion of blood is greater becauſe the veſſels are grown larger and the blood gotten a fuller courſe vnto them. For all virgins although they be neuer ſo mellow, yet haue their firſt coition painfull, but ſome more ſome leſſe; vnleſſe they then are menſtruous, or haue beene within three or foure dayes; for then they admit the yard with leſſe trouble, becauſe of the relaxation and lubricity of theſe moyſt partes whereupon the Membranes are dilated with little or no paine. And this hath beene the cauſe why ſome men haue vnworthily ſuſpected the vncorrupted chaſtity of their wiues. Wherefore it were fit the mothers or women friends of ſuch Virgins ſhould haue care of their Honor, by giuing warning to their Bride-groomes of their Brides purgations, if at that time they be vpon them; and very often they are when the Brides are growne women and well complexioned, becauſe the ioy and priuate pleaſures of affianced young folkes, as alſo their dancings and frolicke diet with ſuch like, do often by moouing the body accelerate and haſten ſuch purgations, and being come do cauſe them longer to endure.

Why ſome haue no paine in deuirgination.

A good cauеate for Mothers concerning their daughters honor.

The torne Membranes of this production in their vtmoſt compaſſe indented, do ſomtimes hang downe on either hand in the ſides by the cleft like vnto values (for ſo *Pinæus* calleth them) or leafe-gates, which are much leſſe then the *Nymphæ*, but of the ſame figure & vſe. Theſe are not loſt, before a woman hath borne a childe, but are reſerued being returned vpward to the orifice of the necke of the wombe, nowe made much wider then in the time of virginity: but in thoſe that haue often brought forth large limb'd Infants, or whoſe wombe hath falne downward and ſo the necke of it being inuerted or turned, they are leſſned and contracted or drawne vpward toward the necke and ſo perfectly vnited to the caruncles to which they adhere, that they ſeeme to be vtterly periſhed.

The Caruncles. Their ſcituation. Their Vſe.

But the foure Caruncles which are like Mirtle berries, whereof one and the foremoſt is placed at the orifice of the bladder, another and the hindmoſt with the two laterall ſcituated not ouer-thwart but length-wiſe; theſe I ſay doe remaine as long as the woman liueth, though ſhe liue verie long. Their vſe, as alſo that of the Membranes when they are reflected vpward, is immediately to ſtop the orifice of the necke of the womb as a fleſhy production doth ſtop the necke of the bladder; they hinder alſo the ingreſſe of cold aire, duſt, or any other ſuch like (in which ſeruice they are aſſiſted alſo by the *Nymphæ*, and the wings of the lap or priuity) and in coition doe aggrate the member of the man; for when they are heated and grow turgid with ſpirits, they ſo conſtringe the yard eſpecially in yong women, as if it were cloſely preſſed in the hand.

The outward Orifice of the necke.

Next to theſe is the rugous or plighted chinke or rifte, which is placed as it were in the trench of the great Cleft, and like a narrow valley leadeth the way by a round cauitie into the inward parts, and maketh the outward orifice of the necke. *Galen* in his 15. Booke *De vſu partium*, and the third chapter, calleth it στόμα τραχήλε, or the outward orifice of the neck of the wombe, by which the yard is receyued to prouoke the parts of the woman to yeelde theyr ſeede, and to infuſe his owne. This orifice ſometimes by a diſeaſe called *Rhagades*, otherwhile by a great cicatrice or ſcar bred after ſom other exulceration, is ſo ſtreightned, that ſuch women can no more admit their husbands; ſometimes through a notable exulceration after a hard trauell it groweth cleane vp, which once we obſerued (ſaith *Bauhine*) in an honorable Matron in whom there appeared not any ſigne of an entrance, but after a whole yeare keeping her owne counſell her courſes being all that while ſtopped, ſhee was tormented with many conuulſiue fittes of the Mother, and ſo periſhed through her owne default.

The diſeaſes of it.

A Story out of Bauhine.

The skinny ligament

Heere is alſo to be obſerued a skinny Ligament in the backe part of the outwarde Orifice of the necke, which in virgins is ſtraighter and is couered by the trench, but in thoſe that haue brought foorth it is much more laxe and looſe; ſo that the looſeneſſe of this Ligament or skinny tye is the onely ſigne that a woman hath borne a childe; for it is ſo alwayes in ſuch and in none but ſuch, vnleſſe in others the wombe do, or haue falne downe; to this ſigne there happeneth ſometimes another, and that is the ruggedneſſe or ſmall plightes of the skinne of the lower bellie, which being ſtrained in trauell remaineth euer after rugous.

A pretty obſeruation concerning this Ligament.

CHAP.

CHAP. XVI. *Of the Lap or Priuities.*

THE laſt diſsimilar part of the wombe, *Galen* in his 14. and 15. Bookes *De vſu partium*, the ſixt and the third Chapters, calleth αἰδοῖον γυναικεῖον, in Latine *pudendum muliebre*, that is, the womans modeſty, [Tab.9.fig.2.l. fig 4. neere n o] of ſome *Vulua*, as it were *vallis* a valley, or *Valua* a Flood-gate, becauſe it is diuided into two parts by a cleft, which like Flood-gates or leafe-doores are eaſily opened or ſhut as neede is. We will call it the lappe. It is that part into which the necke of the wombe determineth, and is ſeated outwardly at the forepart of the ſhare bone, and is as it were a skinny addition of the necke, as *Galen* ſpeaketh in his foureteenth Booke *de vſu partium*, and the ſixt Chapter, aunſwering to the prepuce or foreskin of a man. In this there are many parts to be diſcerned without diſſection. Of which ſome are altogether outward, offering themſelues before the wings be diſplayed; others inward, not appearing before the wings be opened and ſeperated on both ſides. Of which we will firſt entreate.

The names of the lap.

The poſition of it.

The parts of it.

There is therefore a large trench, in which are the paſſage of the necke [Table.9.fig,2.m. fig.3.c. fig.4.l] of the bladder with a Caruncle, the *Nymphæ* and the *Clitoris*. For, although the Hymen and his membranes and caruncles with the ſlitte and the orifice of the necke may alſo be ſeene without diſſection, yet becauſe they pertaine not to the lap but to the necke of the wombe, we haue deſcribed them already.

The inner partes of the Lap.

At the end therefore of the necke of the wombe, immedietely vnder the ſhare-bone, lightly aboue the lap it ſelfe, on the fore-part there is an entrance or paſſage which commeth out of the implantation of the necke of the bladder, by which the vrine is let out into the vtmoſt part of the necke of the wombe, or rather into the lap it ſelfe, euen as in a man the vrine floweth out of the paſſage or channell which is appointed for the ſeede. In the compaſſe of this there is a caruncle [Tab.9.fig.4.p] or a little fleſhy hillocke by which this paſſage is couered, that after the vrine is let go, the outward aire ſhoulde not get into the bladder through his necke which is ſhort and wide; which caruncle alſo as it regardeth the trench, ſtrengthneth the leafe-gate or locke of virginity.

The paſſage of the vrine.

The caruncle belonging to it.

The *Nymphæ*, ſo called by *Galen*, of others πτερυγώματα καὶ πτερύγια, becauſe they firſt admit the man, of the Latines *Alæ* the wings, of others skinny caruncles, are two productions on either ſide one in the beginning almoſt ioyned; which ariſe from a welt or gard of the skin of the ſubſtance of a Ligament in the backe part of the orifice of the necke, and lying hid betweene the two lips of the lap and almoſt alwayes touching one another, do aſcend to the end of the commiſſure or meeting of the ſhare-bones. Theſe being ioyned doe make a fleſhy eminence, and couering the *Clitoris* with a fore-skin aſcend with a manifeſt riſing Line to the top of the great cleft: they are longer from their middle outward and do hang ſometimes a little foorth through the great cleft, without the lips of the lap, and that with a blunt angle, being otherwiſe of a triangular figure.

The *Nymphæ*.

Their ſituation.

They are very like in colour and ſhape to that part of a Cockes combe which hangs vnder his throate. Their ſubſtance is partly fleſhy, partly membranous, ſoft and fungous, & they are inueſted with a thin coate. Somtimes, they grow to ſo great a length on one ſide, more rarely on both; and not ſo ordinarily in maidens as in women, (and then it is called by *Ruffus* χάρκωσις,) what through the affluence of humours, what through attrectation, that for the trouble and ſhame (being in many Countryes a notable argument of petulancie & immodeſty) they neede the Chirurgions helpe to cut them off (although they bleed much and are hardly cicatriſed) eſpecially among the Egyptians, amongeſt whom this accident (as *Galen* ſaith) is very familiar. Wherefore in Maidens before they grow too long they cut them off, and before they marry.

Their ſubſtance.

The Egyptian women laſcinious.

Theſe *Nymphæ*, beſide the great pleaſure women haue by them in coition, doe alſo defend the wombe from outward iniuries, being of that vſe to the orifice of the necke which the foreskin is to the yard; for they do not onely ſhut the cleft as it were with lips, but alſo immediately defend the orifice as well of the bladder as the wombe from colde aire and other hurtfull things. Moreouer, they leade the vrine through a long paſſage as it were betweene two walles, receyuing it from the bottome of the cleft as out of a Tunnell: from whence it is that it ruuneth foorth in a broad ſtreame with a hiſsing noiſe, not wetting the wings of the lap in the paſſage; and from theſe vſes they haue their name of Nymphes, becauſe they ioyne vnto the paſſage of the vrine, and the necke of the wombe; out of which,

Their vſes.

Why they are called *Nymphæ*.

as

as out of fountaines (and the *Nymphes* are fayed to bee presedents or dieties of the fountaines) water and humours doe issue: and beside, because in them are the veneriall delicacies, for the Poets say that the Nymphes lasciuiously seeke out the Satyres among the woods and forrests.

Clitoris in Greeke κλειτορὶς commeth of an obscœne worde signifying contrectation but properly it is called the womans yard. It is a small production in the vpper, forward [table 9. figure 4.m] and middle fatty part of the share, in the top of the greater cleft where the *Nymphes* doe meet, and is answerable to the member of the man, from which it differs in the length, the common passage and the want of one paire of muscles; but agrees in scituation, substance and composition. For it consisteth of two neruous bodies (which *Laurentius* cals ligaments) round without, hard and thick; but within spongy and porous, that vvhen the spirits come into it, it may bee distended and grow loose when they are disipated, these bodies, as those of the mans yarde, are full of blacke, thicke and sprightfull blood.

How it differeth from a mans.

The substãce.

The originall of it.

Their originall is from both the share-bones where they ioyne with the bone of the hip, and are seuered at first, but after they are gone a little foreward they are vnited about the coniunction of the sharebones, and so make the body of a yard harde and solide, and haue a termination like the nut, to which on either side is adioyned a small muscle.

The head is properly called *Tentigo* by Iuuenall, which is couered with a fine skin made of the coniunction of the *Nymphæ* as it were with a fore-skinne. It hath an entrance but no through passage; there are vesselles also running along the backe of it as in a mans yarde; and although for the most part it hath but a small production hidden vnder the *Nymphes* and hard to be felt but with curiosity, yet sometimes it groweth to such a length that it hangeth without the cleft like a mans member, especially when it is fretted with the touch of the cloaths, and so strutteth and groweth to a rigiditie as doth the yarde of a man. And this part it is which those wicked women doe abuse called *Tribades* (often mentioned by many authours, and in some stãtes worthily punished) to their mutuall and vnnaturall lustes.

Tribades odiosæ feminæ.

Leo Africanus, Cœlius Aurelianus.

The vse of it.

The vse of this part is the same with the bridle of the yard; for because the Testicles of the women are far distant from the yard of the man, the imagination is carried to the spermaticall vessels by the motion and attrition of this *Clitoris*, together with the lower ligatures of the wombe, whose originall toucheth, cleaueth and is tyed to the leading vesselles of the seede, and so the profusion of their seede is stirred vp for generation, for which businesse it was not necessary it should be large: wherefore although by this passage their seede is not eiaculated, yet by the attrition of it their imagination is wrought to call that out that lyeth deeply hidden in the body, and hence it is called *æstrum Veneris* & *dulcedo amoris*; for in it with the ligaments inserted into it is, the especiall seate of delight in their veneral imbracements, as *Columbus* imagineth he first discouered.

The wise disposition of nature.

For Nature who wisheth as *Galen* sayth in his 14. Booke *de vsu partium* and the second Chapter, that if it might be, her worke might be immortal, and falling from that hope because of the contrariety of the matter, hath giuen to all creatures both the instruments of conception, and hath also infused into them a straunge and violent kinde of delight, that none of the *kindes* of the creatures should perish but remayne euer after a sort immortall. And truely it was very necessary that there should be a kinde of pleasant force or violence in the Nature of mankinde to transport him out of himselfe or beside himselfe as it were, in the act of generation; to which otherwise being maister of himselfe he would hardly haue beene drawne; which extasie, (for it is called a little *Epilepsie* or falling sicknes) is caused by the touch of the seede vpon the neruous and quicke sensed parts as it passeth by them.

To draw to an end. Those parts which appeare outwardly are the great slit, the lips and the groyne or leske: for as soon as the lippes are diuided, there appeare three clefts or slits; one and the greatest which is the first and vtmost, and two lesser and collaterall betweene the *Nymphes*, the vse of which is to close vp the parts more safely. But that cleft which is called σχίσμα or the great and long fissure is made by the lips and bendeth backward to the Fundament from the share-bones downward toward the cleft of the buttocks: for it ought to bee longer then the orifice, least the Infant should bee hindered in the birth, because the skinne is much thicker and not so yeelding as are membranes: and the more it tendeth backward the deeper and broader it is, and so degenerateth into a trench or valley, representing the figure of a boate, and endeth in the welt of the orifice of the necke. In the mid-

The outward parts of the lip.

σχίσμα the great fissure.

dle

die of this trench is placed the orifice of the necke, and this is the fiſſure that admitteth the yard, and is a part thought too obſcœne to look vpon; which is the reaſon ſayth *Pliny* that the carcaſſes of women doe floate in the water with their faces downeward, contrary to mens which ſwimme vpward; euen Nature it ſelfe yeelding to modeſty; although the cauſe alſo may bee referred to the largenes of a womans belly, as alſo becauſe the water getting into the lap filleth the belly, and for that the waight of her breaſts turneth her body downwards.

The reaſons why the carcaſſes of women floate with their faces downeward.

The two lips which *Hippocrates* in his Booke *de locis in homine* calleth κρήμνα follow next, which make the fiſſure of the outward orifice; they are long, ſoft and of a skinny ſubſtance and fleſhy withall, after a ſort glandulous and ſpongy, and vnder them haue a hard fat and are as it were callous. They are couered with a thin skinne, and are in married women more ſmooth and depreſſed.

The lips.

The extuberations of theſe winges are called hillocks or mountainets (*Veſalius* calleth theſe extuberations *alæ* or wings, the other *labra* or lippes) and the mount of *Venus*: theſe in mature or ripe women are adorned with haire, the buſh of which is called *pubes* or *pecten*. Theſe hayres are in women more curled then in Virgins, and do reach as a couering vnto the lippes; the lippes were made for ornament and for defence that the womb might be kept from refrigeration.

Mons veneris the mountain of Venus. *Pubes, pecten,* or the buſh. Their vſe.

But if in the demonſtration of the wombe we will begin at the externall parts, wee muſt proceede by the guide of a vterine probe, and then the partes will thus ariſe. Firſt the region of the ſhare-bones, then the buſh, the hillocks whereon the hayre growes, the two lips, the great outward fiſſure betweene the lippes making the outward orifice, the trench like a boate, the two ſmaller clefts or fiſſures between the Nymphes, the two Nymphes themſelues; the *Tentigo* or head or nutte of the *Clitoris* couered by the Nymphes as by a foreskin and the impaſſable paſſage of it; the two bodies of the *Clitoris* and two muſcles belonging to it; the paſſage of the necke of the bladder with the Caruncle or fleſhy hillocke which couers it; the skinny ligament which wee ſayed was a ſigne whether a woman had beene a mother or no; the rugous fiſſure or cleft making the orifice of the necke; the foure Caruncles and the foure membranes between them making the *Hymen* in virgins, the neck or canale of the wombe, all theſe may be ſeene without inciſion, the reſt muſt be found by inciſion.

Another way of demonſtration of the parts and appurtenances of the wombe.

And thus much of the parts of generation belonging to women: now the diſcourſe of Hermophradites or of *Androgunes* that are both man and woman, wee will referre to another place.

CHAP. XVII. *Of the wombe of a Sheepe and a Dogge.*

NOw becauſe in the want of woemens bodies it is an ordinary cuſtome for Anatomiſts to exerciſe themſelues and their auditors in the diſſection of the wombes of other creatures; therefore I will ſhortly exhibite vnto you the wombe of an Ewe and a Bitch, as wel by way of hiſtory as alſo by a Table carued onely for that purpoſe.

Why we haue added this chapter.

In an Ewe therefore the necke of the wombe reacheth from the priuity to the top of the Holy-bone, where beginneth the bottom of the wombe ſpreading it ſelfe a litle in the region of the Loynes. This womb is a long body preſſed on either ſide, but toward the end it parteth into two proceſſes looking vpward and bending outvvard very like the hornes of a Ramme. [table 14. figure 2.ᴱ] The outvvard ſuperficies of the bottome, after the manner of membranes is glib and ſmooth; and is tyed to the neighbour parts (euen as the necke is tyed) by membranous ligaments ariſing from the *Peritonæum*, through vvhich there are alſo veſſelles diſſeminated vvhich are ſent vnto the vvombe. The proceſſes of the bottome vvhere they are diuided aſunder on the inſides are alſo ſmooth, and doe grovve to many particles of the belly, but their outſides are continued vvith the bottome of the vvombe it ſelfe by certaine membranes.

The womb of an Ewe or a Cow. The figure. Connexion.

The bottome alſo hath tvvo cauities [table 14. figure 2.ᴰ] vvhich meete at his orifice [table 14. fig. 2.ᶜ] that reacheth vnto the necke. The cauities or boſomes are ſomevvhat yellovviſh, and haue in them many riſings or ſvvellings like little knobbes, vvhich after the creature hath conceiued, open themſelues and make dennes or cauities. If they breed one Lambe, then onely one of the cauities is dilated; if tvvo, then in each cauity is one contayned. The membranes of this vvombe are tvvo, one externall [table 14. figure 2.ᴱᴱ] from the

The bottome. Membranes.

Figure 1. A. The ſpermaticall Veine and artery.
B. Portions of the ſpermatical veſſels reaching branches to the vpper part of the wombe.
C. The Teſticle and the Leading veſſell.
D D A Membrane tying the womb to the *Peritonæum*
E. A veine and an artery diſtributed to the necke of the wombe, and the lower part of the bottome.
F. The right ſide of the bottome of the wombe, couered with the outward coat.
G. the left ſide of the bottom of the womb halfe of it freed from the outward coate.
G, H. The outward couering at G the inward H.
I. The leſte leading veſſel ſeparated from the teſticle.
K. The place where is the orifice of the bottome of the wombe.
L. The necke of the womb, the left ſide is vncouered from the outward coate.
M. A part of the necke of the bladder.
N. The skin left at the priuity.

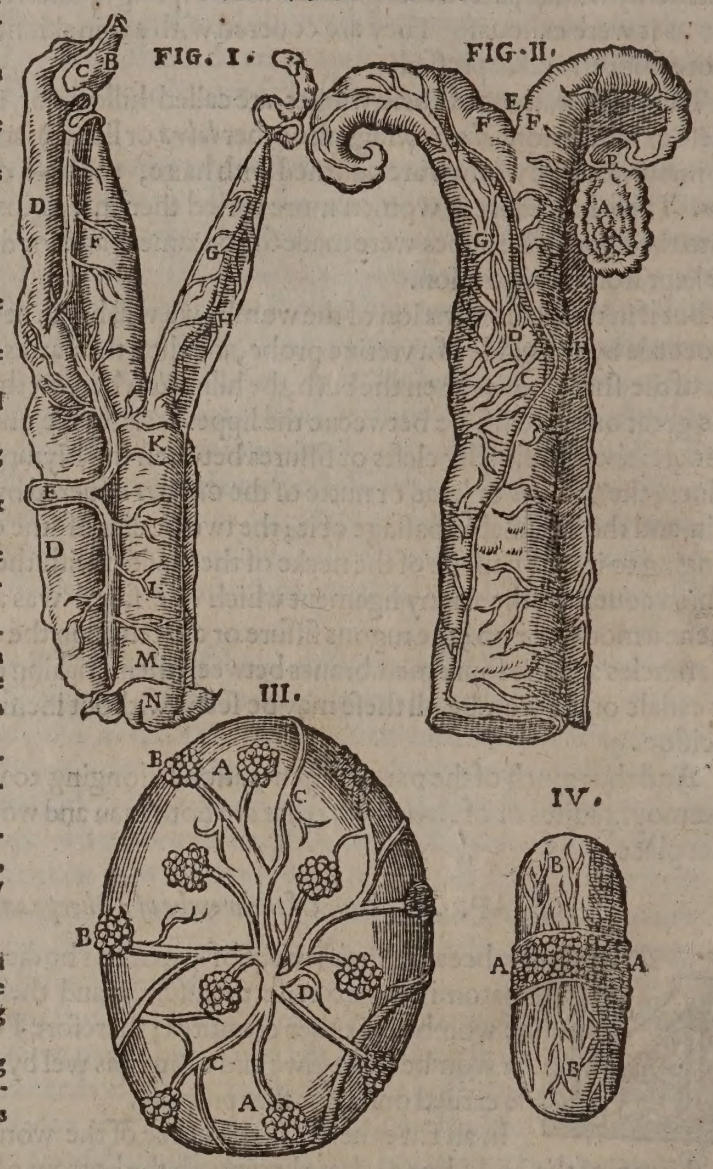
Figure 2. *Figure* 2. A. the left teſticle.
B. The veſſell leading the ſeede into the hornes of the wombe.
C. The place of the orifice of the bottome of the wombe.
D. The place where the wombe is diuided into two parts.
E. The two parts of the womb reſembling the hornes of a Ram.
F F, G. the outward coate of the wombe at F, the inner at G.
H. A portion of a Membrane, ioyning the

Figure 3 womb to the *Peritonæum*. *Figure* 3.
AA The outward couering of the Calfe.
BB. The places where the outward couerings is tied to the wombe, & admitteth the veſſels, where alſo there is a fleſhie ſubſtance, which is likened to the fleſh of the Spleene.
C C. The meeting of the veines and arteries through this couering, for the making of the vmbilicall veſſels.
D. The place where thoſe veynes and arteries diſperſed through this couering, are gathred together a litle before they make the vmbilicall veſſels.

Figure 4 *The fourth Figure.*
A A. A fleſhy ſubſtance growing vpon the outſide of the vtter couering of the Calfe, which compaſſeth the couering ouerthwart, otherwiſe then in men.
B B. That part of the outwarde couering which is not ouer growne with that fleſhy ſubſtance marked with A A. but is branched with veines and arteries.

The firſt figure ſheweth the womb of a dog, becauſe thoſe may more plentifully be gotten for diſſection.
The ſecond figure ſheweth the womb of a Cow (altogether like that of a Sheepe, ſauing that it is bigger, that the hornes might better appeare, becauſe it is fit that yong Anatomiſts ſhou'd excerciſe themſelues in the diſſection of the wombes of ſheepe.
The third ſheweth the after birth or clenſing of a Cow.
The 4. hath another repreſentation of the clenſing of a Cow.

TABVLA XIIII.



the *Peritonæum*, from which the Ligaments do proceede, and wherein the veſſels are leade vnto the wombe. The other internall [Tab. 14, fig. 2.°] and proper, which compaſſeth the

Veſſels. wombe round about.

Betweene theſe coates are diſperſed an infinite number of Veines and Arteries, ſtrangely implicated or folded together; and theſe implications are heere more manifeſt by much then they are in the wombe of a woman, although the coates of her wombe be rent aſſunder. About theſe veſſels there appeare many round bodies like little knubs, which in women are called *Acetabula*, [Tab. 9. fig. 4. about ᴮ and ᴰ] very ſmall they are, and nothing elſe but the mouth of the veſſels.

Acetabula.

The Teſticles Their Teſticles are ſcituated at the ſides of the wombe [Tab. 14. fig. 2, ᴬ] vnder the tops of the hornes. The veſſels which attaine vnto the Teſticles and the womb are the very ſame with thoſe of a woman both in their originall and their paſſage, excepting thoſe which leade the ſeede into the cauity of the womb, whoſe implantation in theſe creatures is much more manifeſt, ſo that you may eaſily enter a Probe into them. Such alſo and after the ſame maner is the faſhion of the wombes of a Goate and of a Cow.

But

But the wombe of a Bitch, [Tab. 14. fig. 1] hath a necke [Tab. 14, fig. 1, r] reaching but to the beginning of the Holy-bone. The bottom is presently diuided into two parts, which by degrees determine in a sharpe end, and do not turne round like the hornes of the womb of an Ewe or Cow, but run out straight. And because these creatures beare many whelps at once in particular parts of their wombe, these parts are distinctly implicated or rowled vp like the guts. The womb of a Bitch.

These two parts of the bottome [Tab. 14, fig. 1. f g] do end in a common orifice, [Table 14, fig. 1, x] which reacheth vnto the vpper part or seate of the necke. It hath a double coat, one outward from the *Peritonæum*, [Tab. 14. fig. 1, pp] from which it hath his processes: the other inward. The two parts of the bottom

The Testicles [Tab. 14. fig. 1, c] are placed at the tops of the two parts of the bottome. The vessels are like those of an Ewe before described, but they haue no such knobbes in the cauities, as we spake of in the former. The Testicles Vessels.

It is a strange thing which *Gesner* and others doe write, that in a *Paria* a Prouince not farre from the Region of the *Patagons* in the West India, there is a creature found which our Country-men cal a half Fox. For it hath two wombs, one inward in which they generate as other creatures do, the other outward situated vnder the former, wherin they cherish and defend their Cubbes, and out of which they seldome take them but vvhen they would sucke. Heere we will put an end to our History of the parts of Generation, & come to the Controuersies. A strange creature in the West India.

¶ A Dilucidation or Exposition of the Controuersies of the fourth Booke.

QVESTION I. *Whether the Testicles be principall parts or no.*

ARistotle & the *Peripatetick* Philosophers do admit but one principall or chiefe part in the body of man which is the Heart, but their opinion is long agoe hissed out of the Physitians Schoole. The *Peripatetians.*

Many do accuse *Galen* of leuity & inconstancy in assigning the number of the principall parts. For sometimes he accounteth the Testicles among the principall parrs, sometimes he excludeth them, but it will not be hard for vs to reconcile *Galen* vnto himselfe. *Galen* accused but redeemed

Lib. de sem. de arte parua. 6. de vsu part. 6. de plac. s.

The Testicles are therefore to be accounted principall parts; and haply so much are they more excellent then the heart, by how much the species or whole kinde is more noble then one *individuum* or particular of the kinde. Surely the power and vertue of the Testicles is very great & incredible, not onely to make the body fruitefull, but also in the alteration of the temperament, the habit, the proper substance of the body, yea & of the maners themselues. In these doth *Galen* place, beside that in the heart, another hearth as it were of the inbred heate, and these are the houshould Goddes which doe blesse and warme the whole bodye. Hence it is, that the Egyptians in their Hieroglyphickes doe paint *Typhon* gelt, signifying thereby his power and soueraignty to be abolished and decayed. The Testicles alter the temper, habit, and maners. Why the Egipt ans painted *Typhō* gelt

That they change the temperament it is manifest, because the testicles being taken away or but fretted, contorred or writhen, yea refrigerated, or hauing suffred convulsion, there presently followeth a change from a hot to a cold temper, and in olde time it was accoun- The temperament.

ted a singular remedy for the leprosie to cut off the Testicles, and to this day we vse to apply Epithymations to them, and finde that they doe wonderfully corroborate and strengthen the whole frame of the body. And it is ordinary for women (and that not vvithout reason) to presume much vppon the death or recouery of children by the firmenesse or loosenesse of these parts; yea *Hippocrates* himselfe sayth in his Prognostickes, *That the Conuulsion of the testicles and priuy parts do threaten danger of death.*

Prognostication by the Testicles.

We see also that in gelt men called Eunuches, there is a change of the whole habite and proper substance of the body, for they become fatter and smooth without haires; the flower also of their bloode decayeth and their vessels or veines loose their bredth and capacity, and all vigour of lust and desire of ioylity is extinguished; beside the flesh of such creatures looseth the former tast and smell; for whereas before it breathed out a certaine vnsauoury and rammish sowrenesse, after they are gelt it becommeth sweete and pleasant to the taste.

The habite.

Concerning the chaunge of their Manners, that is notable of *Auenzoar* the Arabian, where he saith, Eunuchs haue a shrill and piping voice, euill manners, and worse dispositions, neyther shall you lightly finde one of them of a good inclination, or not broken witted. *Claudian* against *Eutropius* inueyeth thus against Eunuchs.

The manners.

Adde quod Eunuchus nulla pietate mouetur,
Nec Generi natisque Cauet.
The Eunuch is deuoide of pietie,
Both to his Parents and his Progenie.

Albeit in the seauenth Booke of the *Institution* of *Cyrus* it is recorded, that this kind of men is quiet, diligent, and especially faithfull: but we may answere that they are quiet because they are dull and blockish; diligent because they are seruile and base-minded; faithfull because they haue so much distrust of themselues. But howsoeuer, whence comes trow we this so sudden alteration of the temper, habit and maners? *Aristotle* thinketh that the heart is stretched by the testicles, and therefore relaxed when they are cut away, and so a common principle affected, because the strength of the Nerues is relaxed or loosened in their originall or beginning. Euen as wee see it commeth to passe in instruments, which haue a more acute or trebble sound when the strings are stretched, and a lower and more remisse when they are loosened; right so it is in Eunuchs, the Testicles being taken away and so the heart affected, the voice and very forme becommeth womanish; for a principle though it be small in quantity, yet it is great in power and efficacy.

Why gelt mē are so chāged

Aristotles prety conceits.

Comparison.

Against this opinion of *Aristotle Galen* disputeth in his first Booke *de Semine*, and we in our next exercise shall prosecute it at large; for neither doeth the strength of the heart depend vpon the contention or stretching of the Testicles but vpon his owne proper temper; neither if the heart needed any such tension or stretching, were the testicles pinnes fitting for the same. The Common opinion is, that all the other parts are heated by the repercussion of heate from the Testicles vnto them; but because their substance is soft and rare, & reflection or repercussion is vsually (especially if it be any thing strong) from thight and hollow bodies, I imagine that their smal and slender reflection can be no cause or author of so powerfull a heat as the parts do stand in need of. *Galen* referres this alteration to the natiue and ingenit temper of the testicles themselues; for in the place last before named he sayth, that in them there is another fountaine or furnace rather of heate, euen as there is in the heart. But vnder correction it seemeth to me more reasonable, that the heate of the Testicles is not so much from their natiue and in-bred temper, because they are without blooce & like vnto Glandules, as by reason of the seed conteyned in them; for where that is it heateth the whole body, distendeth yea enrageth it. For *Hippocrates* saith, that seede is of Nature fiery and aery; by the aery part it distendeth the whole frame of Nature, and by the fiery setteth it on worke, or a gog as we say, transporting not the body onely, but the minde also from reason to rage. For as the least part of mortall poyson in a moment changeth the whole body; so is it in seede, whose quality is so actiue and operatiue, that it darteth forth as it were by irradiation his beames through the whole body. And thence it is, that we see gelt creatures are not so stirring as others, whose many motions do stirre vp and so encrease their heate.

Confuted by Galen.

The common opinion.

Galens opinion

Not altogether allowed.

Comparison.

It may be obiected that *Galen* in another placce attributeth onely to the Liuer and the Heart power to change the whole body, not to the Testicles. For thus hee sayeth: *Those that*

Galen redeemed.

that haue hot Liuers haue also all their habit hot, vnlesse there bee some obstacle in the heart: on the other side they that haue hot heartes haue also hot habites, vnlesse the Liuer doe vehemently oppose against it: but of the Testicles not one worde or any mention at all; these men may thus be satisfied.

There is a twofold influence of heate, one immediate, another mediate. The immediate influence of the twofold spirits and bloud and with them of the heate, is from the heart and liuer by the veines and arteries. The mediate is from the Testicles into the whole body indeede, but by the mediation of the Heart and the Liuer and the common vessels. For the Testicles haue no peculiar vessels by which they might deriue their influence into the whole body; but they impart this power and faculty of alteration, to the heart by the arteries, to the Liuer by the veines; from which it is againe reinfused into the particular members.

A twofold influence of heat.

It will be obiected that this faculty of alteration proceeding from the Testicles is infused not bodily but onely operatiuely; what neede then hath it of a conduite or pipe either arteriall or venall? But I answere, that faculties doe not vse to bee infused or transfused but by the mediation of spirits, which although they wander and gad vp and downe the body; yet notwithstanding they stand neede of peculiar receptacles to containe them in, such as are the veines, nerues, and arteries. So poyson although in the specificall or essentiall form it opposeth the heart, yet is it carried in a moment of time and matter to the heart through the arteries and spirits wherein the faculties haue their consistence.

Obiection.

How faculties are infused.

Comparison.

Such therefore is the excellency, such the admirable faculty of the Testicles, as well in procreation of seede as we shall declare in our next exercise, as also in the alteration of the temper, habit and manners; and in that respect are they called by *Galen, principall parts*.

But their want not aduersaries who would thrust them out of this ranke of dignity; although their arguments are very weake. First they say *Galen* in two places defineth a principall part, in the first by *Necessity*, in the second by *communication of a faculty or some common matter*. But for the Testicles there is no necessity of them, for *Eunuches* liue without them, neither is there any faculty proceeding from them; for the animall faculty proceedeth from the braine, the vitall from the heart, the naturall (to which the faculty of procreation is referred) issueth from the Liuer the chiefe of all naturall partes. Moreouer from the Testicles there is no matter communicated to the whole body, for they haue no spirits proper vnto them, no vesselles which runne through the body by which it may bee conuayed; but these are trifles.

Obiections.

What a principal part is according to *Galen*.

For we confesse the Testicles are not necessary for conseruation of the life of the *individuum* or singular man, but for propagation of the whole species, or of mankinde they are of absolute necessity. Wherefore they are principall parts in respect of mankinde, not in respect of this or that particular man. For the propagation of mankinde is onely accomplished by procreation: procreation is not without seede, seed is only concocted and perfected by the Testicles, to which the spermaticke vessels doe serue as well for preparation as for conduction and leading of the seede.

Answered.

But me thinkes I heare the *Peripatetians* obstreperously deny the Testicles this power of procreation of seede, against whome we will in the next place bend our forces.

Obiections of the preparation of seed.

QVEST. II. *Of the vse of the Testicles.*

CONcerning the vse of the Testicles there are diuerse opinions, and those farre differing one from another. *Aristotle* denyeth them the vertue of making seed and attributeth it onely to the spermaticall vesselles, becaufe many creatures want Testicles, as Fishes and Serpents, which yet enioy a coition, and doe auoyde perfect seede able to propagate their *species* or kinde. That a Bull or Horse hauing lost their Testicles may yet presently couple with their Females and procreate; and finally becaufe they accomplish or fill vp no part of the passages; that is, haue no society with the spermaticke vessels. He taketh knowledge of other vses of these Testicles which he maketh to be threefold.

Aristotles opinion.

His arguments.

3. *Hist. Anim.* 1. & 1. *de gener. Anim.* 4.

The first, that they establish the motion of the seede, and hanging at the vessels inuerted or writhen with a wonderfull art, doe hold them together and make them more patent and ample, (as we see weauers hang waights at the strings of their warp) and therfore when they are cut off, the spermaticall vessels are contracted and their passages occluded or shut vp so as the seede can haue no passage.

His threefold vse of them.

Comparison.

The second vse of the Testicles is for the strength of the heart, for by these as by certain waights the heart is streatched, and thence proceedeth the change of the Temperament and whole habit when they are taken away, the bridle being loosed and the strength of the heart so as it were dissolued or resolued.

The third vse I gather out of his Problemes; that by their waight and poyse they should helpe the tension or erection of the yarde. And this is *Aristotles* opinion of the vse of the Testicles, which we will now bring to the touch-stone to see how it will hold.

Confutation of the first vse

For the first vse he may well be confuted by himselfe: the vessels of seede sayeth he are writhen and intorted with wonderfull art, and implicated or foulded vp in many boughts and circumuolutions; the waight therefore of the Testicles should bee so far from dilating their passages, that if they did streatch them they would rather draw them out in length euen vnto the feete. But the truth is, that these vessels are so firmely tyed to the neighbour parts that they admit no streatching or tension at all, or if they should be streatched they would not onely not be dilated, but they would become narrow and straighter; for vesselles when they are streatched out in length cling closer together.

No vse of any sensible cauity for the seed

But what vse is there of any such sensible cauity or amplitude for the excretion or emission of? Is there not seede contayned in the substance of the Testicles and of the *Epididymis* in which there is no sensible or conspicuous cauity? and is not the seede led along by the leading vesselles to the smal bladders and *Prostatæ*, and there kept in readines for effusion without any cauity? The seed it selfe is houen with aboundance of spirits which maketh it to passe *orgasmo*, that is, with a kinde of impetuous violence. If it be obiected that seede is thicker then arteriall blood which yet hath need of a conspicuous canell or pipe to passe in as are the arteries. I answere, that the arteriall bloud is a plentifull streame ordayned to water the whole body with a continuall and aboundant influxion, which could not bee without very patent and open passages; so Nature formed the arterial veine large and ample, that it might be sufficient to nourish the Lungs, a rare body and in continuall motion. But the seede falleth by degrees and insinuateth it selfe rather then floweth into the spermaticke vessels, and is first prepared in their circumuolutions and after is deriued through small pores and hayrie passages into the substance of the Testicles, and is thence driuen into the eiaculatorie vessels which are indeed porous as an Indian Reede, but haue no sensible cauity at all. There is not therefore required any such rectitude and amplitude in the vessels or substances conteyning the seed as *Aristotle* dreamt of, either for the concoction or eiaculation and auoyding thereof.

Obiection.

Solution.

Arguments against *Aristotle*

But let vs presse *Aristotle* a little farther: although the Testicles doe hang in their due place, yet doe those men become lesse apt for generation who haue their Testicles bruised or worne and wasted or refrigerated, so that euen thence it is manifest that their chiefe vse is not to streatch or dilate the vessels: besides many creatures haue their Testicles within tyed to their backs, and yet are as fruitfull as any other; as some Tuppes or Rammes called Riggall Tuppes, and all female creatures who are very prolifique though their Testicles hang not at all. Furthermore if the Testicles were made as waights to keepe the passages open; then in the time of coition or generation and eiaculation of seede the Testicles should descend downeward that the passages might bee made more patent and open: but we finde the quite contrary to be true, that in coition the Testicles are contracted & drawn vpward, not let lower downward. *Aristotles* nice conceited vse therefore is but suppositious and not the true vse of Nature. *Auerrhois* being not able to auoyde the strength of these reasons, departeth from *Aristotles* opinion to whome he was so much addicted, and yeeldeth that the Testicles haue power to procreate seede.

Auerrhois forsaketh *Aristot.*

Confutation of the 2. vse.

The second vse ascribed to the Testicles by *Aristotle*, is for the tension and strengthning of the heart, to which we answere: that they bee of small waight, neither doe they hang at the heart vnlesse it be by arteries, and those not right but oblique, and yet those adhearing and tyed to the neighbour partes so as the Testicles cannot by them streatch or bend the heart: againe if this were a vse truely assigned, then their hearts and vigor should be strongest whose Testicles are more relaxed and hung lower: but women finde these much more impotent, and account them lazie loyned fellowes: adde hereto, that if the heart needed any tension, it might better haue beene tentered, and with shorter stringes to the spine of the back; also the Liuer is very neare and a waighty body, and tyed to the heart by the hollow vein, & therfore certainly stratcheth it more then the smal bodies of the Testicles placed so farre off and so slenderly depending vpon it, and that by strings fastned to the backe

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by the way: moreouer the veſſels which leade to the Teſticles are diuerſly contorted, and if they weere ſtreatched out woulde reach vnto a mans feete almoſt; againe, all creatures whoſe Teſticles are hidde within ſhould be faynt and crauen-hearted. Finally if this were true, the heart which is a moſt noble part ſhould haue his ſtrength not of himſelfe but by dependencie from elſewhere, which were a great abſurditie in reaſon. Wherfore we think this opinion of *Ariſtotles* to bee but a quaint deuice, worthy of the wit but not of the iudgement of ſo great a Phyloſopher.

Confutation of the laſt vſe. As for the laſt vſe aſsigned by *Ariſtotle* which is the erection of the yarde, that may be confuted by that we haue ſayd before to be the true cauſe of erection, and that is partly Natural; to wit, an aboundance of winde and ſpirits filling the hollow Nerues; and partly Animall, from an appetite mouing the muſcles which are appoynted to make this erection. We will therefore bid adue vnto *Ariſtotle* his faigned conceite, and to them alſo who deny vnto the Teſticles the power of procreating ſeede: for whereas they obiect that there are many creatures which haue no Teſticles and yet doe abound with ſeede prolifique or fitte for generation: wee anſwere that ſuch Creatures are imperfect and their generation not perfect but lame. Obiection. Solution.

How a new gelt horſe may get a foale. To conclude, that a new gelt Horſe or Bull can copulate and ingender ſeemeth hard to be beleeued, becauſe of the extreame payne that muſt neceſſarily follow the violation of parts of ſo exquiſite ſence; but if it do ſo come to paſſe, then is it by that ſeede that is already laboured by the ingenit power of the Teſticles before they were ſeparated and reſerued for preſent vſe in the *Paraſtatæ* and *Proſtatæ*; and not by any ſeed concocted after the taking away of the Teſticles.

QVEST. III. *The opinion of Phiſitians concerning the true vſe of the Teſticles.*

The opinion of ſome Phyſitians. THere are ſome not vnlearned Phyſitians, who will not allow to the Teſticles any power of procreating ſeede, but reſerue that onely for the preparing veſſels and the *Epididymis*; becauſe there appeare no paſſages by which the ſeed ſhould paſſe from the bunching implications of the veſſelles into the Teſticles: againe the *Epididymis* and the preparing and leading veſſels may be ſeparated without rending from the Teſticle: adde hereto that the *Epididymis* is often full of white ſeede, which is rarely found in the Teſticle it ſelfe. They therefore ſay that the Teſticles were made to ſucke away the ſerous humour and excrement of the ſeed and to conteyne it, for which reaſon their ſubſtance is glandulous. Their reaſons. What vſe they aſſigne to the teſticles.

Anſwere to them. Now *Hippocrates* aſsigneth this vſe to Glandules to receiue the excrements of the parts, and therefore the Braine, the Heart, and the Liuer, haue their ſeuerall Emunctories. But for my owne part I ſee no reaſon why the excrement of the ſeede ſhould rather paſſe into the ſubſtance of the Teſticles then the ſeed it ſelfe, which is ſo houen and barmed as it were with ſpirits: beſides, the body of the Teſticles is rare and ſpongy, & hath many ſmall pipes inſerted into them out of the veſſels; wherefore through theſe ſmall and almoſt inſenſible paſſages, they ſucke the ſeede by an ingenit faculty of their own; for if Aliment be brought vnto them to nouriſh them, and yet there are no conſpicuous veſſels diſſeminated through their ſubſtance, I ſee no reaſon but ſeed alſo may without manifeſt veſſels be conueyed into them. Their bodies are indeed glandulous or reſembling Glandules, but very Glandules they are not, as is ſayed already. Another opinion

Another opinion The third opinion concerning the vſe of the Teſticles is theirs who think, that they are ordayned for Pillowes to ſafe-gard and ſtrengthen the veſſels. For ſay they where there is any notable partition of veſſelles in the whole body, there Nature hath appoynted glandules as pillowes to ſecure them. So is the *Pancreas* placed vnder the diuiſion of the *vena porta* or Gate veine, many glandules are in the diuarications of the veines of the meſentery. The *Thymus* vnder the *ſubclauian* diuiſion, and vnder the axillary and crurall veines notorious glandules or kernels are to bee found: in like manner the Teſticles are appointed for the ſecurity of the ſpermaticall veſſels. But the truth is that the onely ignorance of Anatomy brought in this old wiues fable. For the kernels or glandules which are placed at the diuiſions of the veſſels, do on euery ſide ſuſtaine, eſtabliſh and ſupport them; but the Teſticles are hung only at the ends of the veſſels. Which ignorance of Anatomy hath brought forth

The true opinion of almoſt all Phyſitians Wherefore the opinion of *Hippocrates*, *Galen* and almoſt of all the Phiſitians is much more probable, who doe attribute to the teſticles a power of their own to procreate ſeed, and the prime place in the worke of generation, becauſe they haue a great power for alteration of the habit, the temperament and the manners themſelues. Moreouer thoſe creatures

Their reaſons

atures who haue abſtained long from the worke of generation, haue their Teſticles ſwolne and diſtended with ſeede, which vppon the vſe of the Female doe abate againe. Which thing alſo *Ariſtotle* himſelfe hath left teſtimony of where he ſayeth. *That certaine Birds and Beaſtes at what time they vſe to couple, haue their Teſticles very great, but when that ſeaſon is ouer, they become ſo ſmall that it may be doubted whether they haue any Teſticles at all or no*: Againe when the Teſticles are refrigerated or ouer-cooled, then barrennes followeth. And truely if a man liſt to runne ouer all the concoctions in the body of a man, hee ſhall finde that there is onely a preparation in the veſſels, but concoction, and perfect elaboration to be in and from the particular ſubſtance of the part.

Diuerſe inſtances.

The Animall ſpirit as we ſhall declare hereafter, is prepared in the wonderfull implications and texture of the arteries, but his forme and proper difference it acquireth in the marrowy ſubſtance or ventricles of the braine. The Milke is prepared in the veines but groweth white in the glandules of the Breaſtes. Blood getteth a kinde of rudiment in the veines of the meſentery, but his redneſſe and the forme of bloud it onely obteyneth in and by the *Parenchyma* or ſubſtance of the Liuer.

The true courſe of the ſeede.

In the ſmall and threddy veynes of the particular partes there is a preparation vnto the third concoction, but aſsimulation is onely made by and in the ſubſtance of the parts. So there is a delineation and preparation of ſeede in the ſpermaticke veſſels, which are diuerſly implicated by a wonderful artifice of nature, that in thoſe implications the ſpirits might be exactly mingled with the bloud, and therefore here an artery entreth into a veine, and a veine into an artery.

The ſeede thus prepared the Teſticles draw for their nouriſhment, to which they giue forme, perfection, and fœcundity, wherewith when they are ſatisfied, the remainder they expell into the leading veſſels: theſe doe exonerate themſelues into many ſmall bladders, and into the *Proſtatæ*, and there it is reſerued and kept in ſtore for the neceſſary vſe of Nature in procreation.

QVEST. IIII. *Of the ſubſtance and coates of the Teſticles.*

That the Teſticles are not glandules. The differẽce between a glandule and a glandulous body.

THE ſubſtance of the Teſticles ſome ſay are Glandules, alleadging *Galen*, who reckoneth them among the Glandules in his third Booke *de Alimentis*: and *Hippocrates* in his Booke of Glandules defineth them to be ſpongy, rare, fatte and friable, but ſuch are the Teſticles, therefore they are Glandules. We anſwere that we muſt diſtinguiſh betweene Glandules and glandulous bodies. The Teſticles are indeede glandulous bodies, ſo are the Kidneyes, ſo is the Braine, yet no man will call it a Glandule, but the body of it is like a Glandule, as wee ſhall ſhew more at large when we ſpeake of the Braine.

Of their coats How many coates ſtones haue.

Varicoſum corpus.

Againe, concerning the coates of the Teſticles, Anatomiſts doe differ one from another, ſome make more, ſome fewer: we reſolue they are foure; two common and two proper; the two common are called *ſcrotum* or the Cod and *darton*: the two proper called *Eleuthroides* the firſt, and ὑμὴν νευρώδης, that is the neruous membrane the latter. *Veſalius* calleth this *Epididymida*; but *Falopius* elegantly confuteth him; for the *Epididymis* is indeede that we call *Paraſtatæ*, and is a body not a membrane, a little Teſticle not a coate of the Teſticle as the word ſignifieth: euen as a Cuticle is a ſmall skinne; the *Epiglotis* a ſmal toung as it were. And *Galen* in the 15. and 16. Chapters of his Booke *de ſemine* calleth the *Epididymis* a particle fixed to the head of the Teſticle, which wee haue ſeene to ſwell notably, the Teſticle it ſelfe not being taynted at all, yea, and many *Epilepticall* fittes to ariſe therefrom.

The Teſticles of women haue not this additament, or if they haue it is ſo ſmal that it cannot be perceiued. The reaſon may be becauſe it was not neceſſary that their ſeede ſhould be ſo laboured or thicke as that of mens, but remaineth more moyſt and fluid, as it were to temper the action of the ſeede of man.

QVEST. V. *Of the conſent betweene the Cheſt and the Teſticles.*

The conſent betweene the Cheſt and the teſticles. Three places of *Hippocrates* expounded.

THE Conſent betweene the Cheſt and the Teſticles is expreſſed by *Hippocrates* in three ſeuerall places. In the firſt Section of the ſecond Booke *Epid.* he ſayeth, *When the Teſticle ſwelleth after a Cough, it calleth to our remembrances the conſent or ſympathy betweene the Cheſt, the Breaſts, the Seede & the Voice.* Againe, in the firſt Section of the firſt Booke thus; *Many were ouertaken with*

dry

dry Coughes, & many of those men long after were troubled with painful inflamations, sometimes in one stone, sometimes in both. Thirdly in the first againe of the second Booke thus: *Long and inueterate Coughes doe cease when the Testicles begin to swell.* Howe this commeth to passe we will now declare: but first it must be resolued what that diuine old man meant by dry Coughes; not that Cough which is without matter; caused either by a bare distemper as when the winde is at the North, or by the inequality of the rough Artery, or by the sympathy of the sinnewy parts, for how could that breede tumors and Apostemations? But a Cough with a matter, whose cause is either the thinnesse of the matter, which the breath cannot intercept as we cough, but it slideth downe by the sides of the weazon; or else the thicknes of the same which will not follow the constraint of the chest. This matter whither thin or thicke *Hippocrates* vnderstandeth to be euacuated by Apostemations belowe, and especially in the coddes or testicles: but all the difficulty is, which way this crude matter should passe out of the chest vnto the parts of generation.

What *Hipoc.* meaneth by a dry cough.

The wayes by which the humor must pas out of the chest in to the testicles.

There are three sorts of vessels which goe to the Testicles; A Nerue, an Artery, and a veine, all which haue through-passages from the chest to the testicles. First of al, a notable and euident branch of the rib sinnew called *Costalis*, runneth by the sides of the ribs into the Testicles. A veine from the *non-paril* or vnmated veine of the breast runneth thorough the Midriffe, and determineth into the veine of the Kidney, and the spermaticall veines. As for the Artery, albeit none do come to the great trunke from the Lunges (in whose lappes the matter of the cough doth lye) yet it is not vnreasonable to thinke that the offending humour may passe by the venall artery into the left ventricle of the heart, and from thence into the great Artery, and so into his branches; by which way also the matter or *pus* of *pleuriticall* and *Peripneumonicall*, or *Empyicall* patients descendeth, and so is diuersly auoyded by vrine, seidge, or Apostemations in the lower parts; and by this passage also it is more then probable, that the matter should fall out of the chest to the testicles.

The way of the Nerue.

The way of the Veine.

The way of the Arteire.

The passage of matter thorough the left Ventricle of the heart.

QVEST. VI. *Of the situation of the Prostatæ.*

That the *Prostatæ* are aboue the sphincter.

Concerning the Glandules called *Prostatæ*, Anatomists doe contend; some thinke they are placed beneath the sphincter Muscle, others aboue, we adhere to the latter. For, beside the credite of dissection, if they were placed below the sphincter then the seede should neuer be spent without the auoyding of vrine also, & again in the running of the reines, the seed could not flow without the water; besides the Vrine would alwayes lye vpon these Glandules and fret them with his acrimony. They are therefore placed aboue the sphincter, and their inflamation or exulceration breeds the venerious gonorrhæa or running of the reines.

QVEST. VII. *Whether the Erection of the yard be a Naturall or an Animall action.*

How manie sorts of actions there are

Every action according to *Galen*, is Naturall or Animall; that he calleth Naturall which is not voluntary, so the vitall faculty is Naturall becaus it is not Arbitrary. The inflation of the virile member is an action, becaus there is in it Locall and Mathematicall motion, it must therefore needs be a Naturall or an Anmiall, or a mixt action.

That erection is meerely Animal.

To prooue it to be meerely Animall this argument is vrged, becaus all the Animal faculties, Imagination, Motion, and Sense do concurre to the perfection of it. For the first, before the distention of this part, whether wee wake or sleepe wanton and lasciuious imaginations do trouble vs. Now mens Imaginations when they wake are alwayes voluntary and arbitrary with election; and when they sleepe, then are their imaginations like those of bruite beasts, following the species or Idea and representations of the seede as it pricketh & swelleth these parts of generation. For euen as in sleepe Flegme stirreth vp in our imaginations similitudes of raine and waters, Choler of rage and fury like vnto it selfe, Melancholy that enemy of the light and demolisher of the principles of life it selfe, powreth a cloude of darkenesse ouer our minde, and representeth to our imaginations similitudes full of terror and feare; right so the seede contained in the *Prostatæ* swelling with aboundance by his tickling or itching quality communicated to the braine by the continuity of the sinnewes, mooueth or stirreth vp images or shaddowes of venerious delights in the fantasies of men, wherefore this part or member is not erected without the helpe of the imagination.

The effects of the humours in sleepe.

How venerious imaginations in sleep are mooued.

The

The Senſe mooueth the imagination, the imagination commandeth the mooving Faculty, that obeyeth, and ſo it is puffed vp. The mooving Faculty hath the help of four Muſcles, two of which run along the ſides of the member; now wee know that all motions of the Muſcles is Animall, becauſe a Muſcle is defined to be an inſtrument of voluntary motion. This inflation hath pleaſure alſo ioyned vnto it, but pleaſure is not without ſence; wherefore all theſe three Animall faculties concurre in erection, and therefore it is meerly an Animall action.

That it is meerly naturall.

On the contrary that it is a Naturall action may thus bee demonſtrated: all the cauſes of this diſtention, the inſtruments, the efficients and the end are Naturall.

The inſtruments.

The Naturall organs or inſtruments are two ligaments, hollow, fungous and blacke, which though they be called Nerues, yet are not voluntary and ſenſible or feeling ſinewes, they ariſe from the

The efficient.

hanch and ſhare-bones, not from the brayne or marrow of the backe. The efficient cauſe is not our will, becauſe erection is not alwayes at our commaundement either to moue or to appeaſe as we may doe our armes, legges and eyes; but the efficient cauſe is heate, ſpirites and winde, which fill and diſtend theſe hollow bodies, with an infinite number of veſ-

The finall.

ſelles both veines and arteries diſperſed and wouen through them. The finall cauſe is procreation which belongeth to the Naturall not to the Animall faculty.

The middle and true opinion that it is a mixt action.

Betwixt theſe two extreames we wil take the middle way and determine, that the action of erection is neyther meerely Animall nor meere Naturall, but a mixed action. In reſpect of the imagination & the ſence it is Animall, becauſe it is not diſtended vnleſſe ſome luxurious imagination goe before, and the diſtention when it is made is alwayes accompanied with a ſence of pleaſure and delight; but in reſpect of the motion we rather thinke

Compariſon from the appetite.

it to be Naturall which yet is ſomewhat holpen by the Animal. For as the appetite which is ſtirred vp in the vppermoſt mouth of the ſtomacke (becauſe traction breedes diuulſion, diuulſion ſence, ſence Appetite) is called Animall; and yet the motion wherby the greedy ſtomacke ſometimes ſnatcheth vnchewed meate euen out of the mouth is Naturall: ſo the erection of this member becauſe it is with ſence and imagination is ſayed to bee Animall, but the locall motion whereby it is mathematically inlarged is Natural, ariſing from the inbred faculty of the ligaments: ſuch is alſo the motion of the wombe when it draweth ſeed, and of the heart when it draweth into it ſelfe ayre and bloud. Yet it muſt be confeſſed that this naturall motion is holpen by the Animal, becauſe the foure muſcles before mentioned though they be very ſmall, yet they helpe to enlarge the diſtention, and doe alſo for a time keep it ſo diſtended.

Obiection.

If it be obiected that in the running of the Reynes called the venereall *Gonorrhæa*, there

Solution.

is erection without imagination or pleaſure, yea with payne. I anſwere with *Galen* that there is a twofould erection, one according to nature, another vnnaturall; the firſt is from the ingenit faculty of the hollow ligament; the other is ſymptomaticall; the firſt with pleaſure, the other without it yea with payne; in the firſt the yarde is firſt diſtended and after

Compariſons.

filled with a vaporous ſpirite; in the latter it is firſt filled then after diſtended. In a word, there is the ſame difference betweene theſe two diſtentions which is between the two motions of the heart. In the Naturall motion of the heart which is accompliſhed by the vitall faculty, becauſe the heart is dilated it is filled with ayre and bloud, and becauſe it is contracted it is emptyed; but in the depraued palpitation of the heart the heart is diſtended becauſe it is filled. So ſmiths bellowes becauſe they are dilated are preſently filled with ayre for the auoyding of vacuity, but bottles are diſtended becauſe they are filled with wine or water.

Priapiſmus.

Wherefore the Naturall erection euer followeth imagination and hath pleaſure accompanying it, but the vnnaturall which *Galen* calleth *Priapiſmus*, is altogether without luſt or appetite. The cauſe of this is a plenitude of thick & craſſe wind, proued becauſe the

The cauſes of it.

motion is ſo ſudden and ſo violent; for all violent and ſudden motions are of winde not of humor as *Galen* ſaith; and this wind or vapour is generated either in the hollow nerues and ligaments, or is thither brought by the open paſſages of the arteries. But of what? Surely of craſſe and thicke humours, and that is the reaſon why melancholly men are moſt trou-

Melancholly men ſubiect to it and why.

bled with this vnnaturall erection; as alſo are Lepers, and therefore the Antients called the Leproſie *ſatyriaſis*. And thus much concerning the parts of generation in men, now it followeth concerning thoſe of women.

QVEST

QVEST. VIII. *How the parts of generation in men and women doe differ.*

Whether the parts of generation in men and women do onely differ in scituation.

OConcerning the parts of generation in women, it is a great and notable question whether they differ onely in scituation from those of men. For the ancients haue thought that a woman might become a man, but not on the contrary side a man become a woman. For they say that the parts of generation in women ly hid, because the strength of their naturall heate is weaker then in men in whom it thrusteth those parts outward. Women haue spermaticall vessels, aswell preparing as Leading vessels and testicles which boile the blood, and a kinde of yard also, which they say is the necke of the wombe if it be inuerted. Finally, the bottome of the wombe distinguished by the middle line, is the very same with the cod or *scrotum*. This *Galen* often vrgeth in diuers of his works as before is saide; so *Ægineta*, *Auicen*, *Rhasis*, and all of the Greeke and Arabian Families, with whom all Anatomists do consent. For confirmation also heereof there are many stories current among ancient and moderne writers of many woemen turned into men: some of which we will not heere thinke much to remember. First therefore we reade that at Rome when *Licinius Crassus*, and *Cassius Longinus* were Consuls, the seruant of one *Cassinus* of a maide became a young man, and was thereupon led aside into the desert Island of the Sooth-sayers. *Mutianus Licinius* reporteth, that at *Argos* in Greece, he saw a maide named *Arescusa*, who after she was married became a man and had a beard and after married another woman by whom she had yssue.

Reasons for it

Authors.

Exampless *Cassinus* Maid-seruant.

Arescusa.

Pliny also writeth, that he saw in *Affrica P. Cossitius* a Citizen of *Tisdetra*, who of a woman the day before became a man the next day. The *Hyæna* also a cruell and subtle Beast, doth euery other yeare change her sexe. Of whom, *Ouid* in the xv. of his Metamorphosis saith:

Cossitius.
The *Hyæna.*

Et quæ modo fœmina tergo
Passa marem, nunc esse marem miramur Hyænam.
The same *Hyæna* which we saw admit the male before,
To couer now her female mate, we can but wonder sore.

Pontanus hath the same of *Iphis* in an elegant verse:

Iphis.

Vota puer soluit quæ fœmina vouerat Iphis.
Iphis her vow benempt a Maide,
But turned boy her vow she paide.

Of later times. *Volateran* a Cardinall saith, that in the time of Pope *Alexander* the sixt he saw at Rome a virgin, who on the day of her mariage had suddenly a virile member grown out of her body. We reade also that there was at *Auscis* in *Vasconia*, a man of aboue sixtie yeares of age, grey, strong and hairy, who had beene before a woman till the age of xv. yeares, or till within xv. yeares of threescore, yet at length by accident of a fall, the Ligaments (saith my Author) being broken, her priuities came outward, and she changed her sex; before which change she had neuer had her couses. *Pontanus* witnesseth that a Fishermans wench of *Caieta* of fourteene yeares olde became suddenly a young springall. The same happened to *Emilia* the wife of *Antonie Spensa* a Citizen of *Ebula*, when she had been twelues yeares a married woman.

A story of *Volateran* the Cardinall.
Another in *Auscis.*

A Fishermans wench of *Caieta.*
Emilia.

In the time of *Ferdinand* the first K. of *Naples*, *Carlota* and *Franciscа* the daughters of *Ludouike Quarna* of *Salernum*, when they were 15. years old changed their sex. *Amatus Lusitanus* testifieth in his Centuries that hee saw the same at *Conibrica* a famous towne of *Portugall*. There standeth vpon record in the eight section of the sixt Booke of *Hippocrates* his *Epidemia*, an elegant History of one *Phaetusa*, who when her husband was banished was so ouergrown with sorrow, that before her time her courses vtterly stopped and her body became manlike & hairy all ouer and she had a beard and her voice grew stronger. The same also he recordeth to haue hapned to *Namisia* the wife of *Gorgippus* in *Thaso*.

Carlota and *Franciscа.*
Amatus Lusitanus his story.
Hippocrates his *Phaetusa.*
Namisia.

Wherefore say they, if a Woman may become a man and her parts of generation which before lay hid within may come foorth and hang as mens do, then do women differ from men onely in the scite or position of their parts of generation.

Notwithstanding all this, against this opinion there are two mighty arguments: one is taken from the ἀυτοψια in dissection, another from reason, which two are the Philosophers Bloud-

Reasons and experience against the former opinion.

Bloud-hounds, by which they tract the cauſes of things.

From the number of the parts.

For firſt of all (ſaith *Laurentius*) theſe partes in men and women differ in number. The ſmall bladders which firſt *Herophylus* found, and called *varicoſos adſtites*, that is, the *Paraſtatæ* women haue not at all; nor the *Proſtatæ* which are placed at the roote of the yard and necke of the bladder, in which ſeede is treaſured vp for the neceſſary vſes of nature; althogh there be ſome that thinke that women haue them but ſo ſmal that they are inſenſible, which is (ſaith he) to begge the queſtion. Againe, me thinks it is very abſurd to ſay, that the neck of the wombe inuerted is like the member of a man; for the necke of the womb hath but one cauity, and that is long and large like a ſneath to receiue the virile member: but the member or yard of a man conſiſteth of two hollow Nerues, a common paſſage for ſeede and vrine, and foure Muſcles. Neyther is the cauity of a mans yard ſo large and ample as that of the necke of the wombe. Add to this, that the necke of the bladder in women doth not equall in length the necke of the womb, but in men it equalleth the whole length of the member or yard. Howſoeuer therefore the necke of the wombe ſhall be inuerted, yet will it neuer make the virile member: for three hollow bodies cannot be made of one, but the yard conſiſteth of three hollow bodies; two Ligaments ariſing from bones and the ἐρηθρα, as we haue before ſufficiently ſhewed. If any man inſtance in the *Tentigo* of the Ancients, or *Fallopius* his *Clitoris*, bearing the ſhape of a mans yard, as which hath two Ligaments and foure Muſcles, yet ſee how theſe two differ. The *Clitoris* is a ſmall body, not continuated at all with the bladder, but placed in the height of the lap, the *Clitoris* hath no paſſage for the emiſsion of ſeede; but the virile member is long and hath a paſſage in the middeſt by which it powreth ſeede into the necke of the wombe.

From the forme & ſtructure of the parts.

What parts of man a woman wanteth.

Concerning *Fallopius* his *Clitoris*.

Neither is there (ſaith *Laurentius*) any ſimilitude betweene the bottome of the wombe inuerted, and the *ſcrotum* or cod of a man: For the cod is a rugous and thin skin, the bottome of the wombe is a very thicke and thight membrane, all fleſhy within and vvouen with manifold fibres.

Concerning the Cod and the bottom of the wombe.

Finally, the inſertion of the ſpermaticke veſſels, the different figure of the mans and womans Teſticles, their magnitude, ſubſtance and ſtructure or compoſition doe ſtrongly gainſay this opinion.

The inſertion of the ſpermaticke Veſſels.

But what ſhall we ſay to thoſe ſo many ſtories of women changed into men? Truely, I thinke ſaith he, all of them monſtrous and ſome not credible. But if ſuch a thing ſhal happen, it may well be anſwered that ſuch parties were Hermophradites, that is, had the parts of both ſexes, which becauſe of the weakeneſſe of their heate in their nonage lay hid, but brake out afterward as their heate grew vnto ſtrength. Or we may ſafely ſay, that there are ſome women ſo hot by nature that their *Clitoris* hangeth foorth in the faſhion of a mans member, which becauſe it may be diſtended and againe growe looſe and flaccid, may deceiue ignorant people. Againe Midwiues may oft be deceiued becauſe of the faultie conformation of thoſe parts, for ſometimes the member and teſticles are ſo ſmall, and ſinke ſo deepe into the body that they cannot eaſily be diſcerned.

Anſweres to the obiection of the change of ſexes.
The firſt
The ſecond.
The third.

Pinæus writeth, that at *Paris* in the yeare, 1577. in the ſtreete of S. *Dennis*, a woman trauelled and brought foorth a ſonne, which becauſe of the weakneſſe of the infant was ſuddenly baptized for a daughter, and was called *Ioanna*. A fewe dayes after, in dreſsing the Infant the Mother perceyued it to be a manchilde and ſo did the ſtanders by and they named it *Iohn*.

A Hiſtorie.

As for the authority of *Hippocrates*. It followeth not that all thoſe women whoſe voyces turne ſtrong or haue beards and grow hairy do preſently alſo change their parts of generation; neither doth *Hippocrates* ſay ſo, but plainly the contrary: for he addeth, *When we had tried all meanes we could not bring downe her courſes, but ſhe periſhed.* Wherefore hir parts of generation remained as thoſe of a Woman, although her bodye grew manniſh and hairie.

Anſwere to the authoritie of *Hippocrates*.

QVESTIO. IX. *Of the motions of the wombe.*

How the womb is ſaide to moue.

ANother queſtion there is, whether the wombe moue locally and Mathematically, or Phyſically onely: concerning which we wil reſolue thus. There is a threefold motion of the wombe, one altogether naturall, another altogether Symptomicall and Convulſiue; the third mixt, partly Naturall partly Symptomical. The Naturall motion is meerely from the faculty of the ſoule; the Symptomatical meerly from an vnhealthfull cauſe, the third from them both together.

A threefolde motion.

The

The naturall motion is when the wombe draweth ſeed out of the neck into his bottom, for then it runneth downward to meete it, inſomuch that ſometimes it hath beene ſeene euen to fall out; it mooueth alſo naturally when in conception it is contracted and imbraceth the ſeede ſtrictly on euery ſide; as alſo when it excludeth the Infant, the after-birth or any other thing contayned in it beſide Nature. For the accompliſhment of this motion it hath right fibres and very many tranſuerſe or ouerthwart, and this motion comes from the neceſsity of Nature.

The natural motion of the wombe.

The ſymptomaticall motion is onely from a cauſe that is morbous or diſeaſefull and that is convulſiue; which motion is manifeſt in the ſuffocation of the matrixe, for then the wombe is moued vpward becauſe it is drawne convulſiuely; and that comes either from repletion or from exhauſtion or emptines, the ligaments either being by drought exſiccated or ſteeped in ouermuch moyſture: ſometimes it commeth from a poyſonous breath, from the ſuppreſsion of the courſes, or the retention and corruption of the womans ſeede falne into it out of the veſſels.

The ſymptomatical motion of the wombe. The ſuffocation or ſtrangulation of the matrixe.

In this convulſiue motion the midriffe is preſſed or borne vp, which is the chiefe inſtrument of free reſpiration or breathing, and the braine is alſo drawn into conſent which is the chiefe ſeate or tribunall of the Animall faculty, which faculty is the efficient cauſe of reſpiration. Hence it is that in ſuch ſuffocations or ſtrangulations there is an interception of reſpiration, for the inſtrumentall cauſe the midriffe is intercepted, the efficient cauſe the Animal faculty alſo, becauſe the braine is drawn into conſent. The finall cauſe alſo is taken away, for the heat of the heart at that time is very ſmall and requireth therefore no other ventilation but by tranſpiration, which is by the pores of the habit of the body.

Why ſuch women do not breath.

All the cauſes of reſpiration in this ſuffocation are taken away.

But you muſt marke that I cal not this motion a convulſion, but onely a convulſiue motion; for convulſion properly is, an vnbidden motion of thoſe parts which we vſe to moue at our commandement, but the wombe is not mooued by our willes but by it owne will, wherefore convulſions belong not to the wombe but to the muſcles onely which are inſtruments of voluntary motion; but abuſiuely we may call this a convulſion as *Hippocrates* calleth the Hiccocke a convulſion.

What parts ſuffer convulſions.

The third motion of the wombe wee ſayed was mixt, proceeding from a morbous or vnhealthy cauſe and partly from the faculty, as in a great exiccation it runneth vpward toward the Liuer which is the fountaine of ſweete moyſture; for all dried partes doe as it were thirſt after this moyſture with a naturall appetite; and this motion is indeede truely mixt, being partly phyſicall or naturall the dry wombe drawing toward the ſeate of moyſture, or drawing the moyſture vnto it ſelfe as *Galen* interpreteth it; and partly mathematicall or locall it mooving as *Hippocrates* ſayeth, with a kinde of impetuous violence to the *præcordia*; although I am not ignorant that *Galen* in this poynt reproueth his maiſter, and taketh this motion to be meerely Phyſicall or naturall; and is called mathematicall by *Hippocrates* but abuſiuely onely.

The 3. mixt motion of the wombe.

QVEST. X. *How the Wombe is affected with ſmelles and ſauours.*

FVrthermore it is not only recorded by antient Authors, but approued by daily experience, that the wombe is much affected with ſauours and ſmelles; ſo that ſome haue beene knowne to miſcarry vpon the ſtench of a candle put out as *Ariſtotle* recordeth is his 8. Booke of the Hiſtory of Creatures and the 24. chapter. But how and by what paſſages this apprehenſion of odours is, few haue ſufficiently declared; wherefore we will payne our ſelues a little and our readers alſo, to lay open this difficulty, becauſe it may be of great vſe for the preſeruation of health, and will not be altogether vnpleaſant to them that deſire to know themſelues.

How the wõb is affected with ſmels and ſauours.

As therefore Colour is the onely obiect of the ſight, ſo is odour of the ſmelling; and as the ſight hath the eye as his peculiar & proper inſtrument of ſeeing, ſo is the noſe (I mean principally the partes contayned within it, that is the ſpongy bone and the two proceſſes called *mamillares*) the onely inſtrument of ſmelling: it were therefore very abſurde to imagine that the wombe did ſmell ſauours or ſmelles, becauſe it is not the proper inſtrument of ſmelling, howe then? It is affected with ſauours by reaſon of the ſubtile and thinne vapour or ſpirite which ariſeth from any ſtrong ſented thing; euen as our ſpirites are refreſhed and exhilerated with ſweete ſauours, not by apprehending the ſent of them; but by receiuing a thinne ayrie vapour from them whereby the ſpirites are nouriſhed, enlightned and ſtrengthned; right ſo is the wombe affected with the vapors of things which yeelde a ſtrong ſmell be it pleaſant or vnpleaſant and that very ſuddenly, becauſe it

Not vnder the forme of ſmels.

But by vapo-rous ſpirits.

is

is a part of exquisite sence. But if it bee so, it may be demaunded, why then the wombe is pleased with sweet smels and displeased with those that are vnpleasant; for it seemeth hereby to make choyce of smelles euen for the very sauour and sent? I answere that all thinges which yeeld a noysome smell are vnconcocted and of a bad or imperfect mixture, & therfore they affect the sence with a kinde of inæquality; or else the spirits or vapours that arise from these ranke bodies are impure (whence come faintings and swoundings sometimes,) and so defile the spirits contayned in these generatiue parts.

Obiection.

Solution.

Obiection. Why muske and Ciuit cause fits of the mother, and stinking things cure it. Answere.

One difficulty there yet remayneth. If the wombe delight in sweete sauours, why then doth the smell of Amber greece, muske and such like bring suffocation of the mother; and that of *assa fœtida* and *castoræum* & such like extreme stinking things cure the same disease? I answere, that all women fall not into suffocation vpon the smelling of sweet perfumes or the like, but onely those whose wombe is especially euilly affected. For sweet smels hauing a quicke spirit arising from them, doe instantly affect the Brayn and the membranes of the same, the membranous wombe is presently drawne into consent with the Brayne and moued, so as those bad vapours which before lay as it were a sleep in the ill affected womb, are now stirred and wrought vp by the arteries or other blinde passages vnto the midriffe, the heart and the braine it selfe, and so comes the suffocation we spake off. But those things that yeeld a noysome sauour, because they are crude and ill mixt, doe stoppe the passages and pores of the braine, and do not reach vnto the inner membranes to affect them: they cure also the *Hysterical paroxisme* or fitte of the mother, because our nature being offended with them as with enimies rowseth vp it selfe against them, and together with the ill vapors excludeth also out of the wombe the euil humors from whence they arise, euen as in acute diseases nature being prouoked by the ill quality of the humors moueth to criticall excretions, or in purgations when she is goaded with the aduerse quality of the medicine relieueth her selfe by euacuation.

It is a signe of an ill disposed wombe to bee offended with sweet things.

How noysom smels cure the suffocation.

Comparisons

But you will aske by what passages are these vapours and spirites carried. I answere, beside the open passages of the arteries by which such ayrie spirits doe continually passe and repasse, in a mans body there are many secret and vnknowne waies which those subtile bodies may easily finde, considering that euen crasse and thicke humours doe ordinarily follow medicines we know not by what passages; as when a little *Elaterium* euen a graine or two will purge away three or foure pintes of water or more which lay before in the capacity of the *Abdomen*, drawing it thence into the guttes, and yet we knowe no direct passages from the one part to the other; and this hath made men to say that as open as the body of glasse is to the light although it be very solide, so open is the whole body as to external aire of which we finde our body oftentimes very sensible, so to humours, much more to spirits and thinne and subtile vapours. Experience hereof we haue in the vse of Tobacco, for a man shall often finde it sensibly in his toes and fingers ends presently vpon the taking.

Obiection. Answere. The passages of these spirits and vapors.

Dropsy water how purged.

The working of Tobacco in the fingers ends.

But of this we shall take leaue in the next discourse to speake a little more largely seeing it not onely concerneth almost all women, but may serue somewhat to stay their minds vpon many accidents which euery day befall them

QVEST. XI. *Of the wonderfull consent betweene the wombe and almost all the parts of womens bodis.*

An enumeration of the parts with which the wombe doth sympathize.

Concerning the wonderfull sympathy that is betweene the wombe and almost all the parts of womens bodies, that place of *Hippocrates* in his Booke *de locis in homine* is most remarkable, where he sayeth, *That the wombs of women are the causes of all diseases*: that is to say, The wombe being affected there follow manifest signes of distemper in all the parts of the body, as the Brayne, the Heart, the Liuer, the Kidneyes, the Bladder, the Guts, the Share-bones: and in all the faculties, Animall, Vitall, and Natural; but aboue all, the sympathy betweene the wombe and the breastes is most notable; yet will we not sticke a little to insist vpon the former particulars.

The consent between the wombe and the braine.

Betweene the Brayne and the wombe there is very great consent, as well by the nerues as by the membranes of the marrow of the backe: hence in affects of the mother come the paynes which some women often feele in the backe-parts of their heade, their frenzies or franticke fittes, their dumbe silence and indeede inabilitie to speake, their strange fearefulnesse, sometimes loathing their liues yet fearing beyond measure to die; their conuulsions, the calligation or dimnesse of their sight, the hissing of their eares, and a world of such like

and

and of vnlike accidents.

Betweene the heart and the wombe the conſent is made by the mediation of manie notable Arteries called Spermaticall and Hypogaſtricall; that is, the Arteries of ſeede, & of the inferiour part of the lower belly. Hence come light faintings, deſperate ſwoondings, the ceſſation of breathing and intermiſsion of the pulſe, the vſe of them both being taken away by a venemous breath, which diſſolueth the naturall heate of the heart; and ſuch women liue onely by tranſpiration; that is by ſuch aer as is drawne through the pores of the skin into the Arteries and ſo reacheth vnto the heart; ſo that it is impoſsible almoſt to perceiue whether ſuch women do yet liue or no, and doubtleſſe many are buried in ſuch fits (for they will laſt ſometimes 24. houres or more, and the bodies grow colde and rigid like dead carkaſſes) who would recouer if ſpace were giuen.

Betweene the heart and the wombe.

What it is to liue by tranſpiration.

Many wome buried quick.

In my time there went a woman begging about this Cittie, who had a Coffin carried with her, and oftentimes ſhe fell into thoſe Hyſtericall fits, and would lye ſo long in them, nothing differing from a dead carkaſſe, till the wonted time of her reuiuing. Hence it may be came the Prouerbe, *Thou ſhalt not beleeue a woman* (that ſhe will die) *no not vvhen ſhee is deade.*

A Hiſtorie.

This is a ſore accident, and therefore it ſhall not bee amiſſe to tell you how you may know whether ſuch haue any life left in them or no. A downy feather applyed vnto their mouth will not ſometimes ſerue the turne, for you ſhall not perceiue it to ſhake and yet the woman liues; the onely infallible token of life or death, is if you apply a cleare looking glaſſe cloſe vpon their mouths, for then if they liue the glaſſe will haue a little dew vpon it, if they be dead none at all. But the ſafeſt way is not to be ouer-haſty to burie women, eſpecially ſuch as dye ſuddenly and not vppon euident cauſe, til 2. or 3 dayes bee ouer, for ſome haue beene knowne ſo long after their ſuppoſed deaths to reuiue, and ſome taken agayne out of their Coffins haue beene found to haue beaten themſelues vpon their reuiuing before their ſtifling into the graue, if we will beleeue the reports of ſuch as we haue no great reaſon to miſtruſt. But to returne to our ſimpathy.

How to know whether a woman be aliue or dead.

A miſerable caſe.

Betweene the Liuer and the wombe the ſimpathy is a little aboue expreſſed, to which we may adde, that as from other parts affected, ſo from the ill affection of the womb, ſometimes come Iaundiſes, Cacexies, that is, ill habits of the bodie, green ſickneſſes, and then which nothing is more ordinary, the Dropſie it ſelfe.

Betweene the Liuer and the wombe ſee aboue.

Iandiſes.

Greenſickneſs

Dropſies.

Betweene the Kidneyes and the wombe the conſent is euident in the torments and pains of the Loines, which women and Maids haue in or about the time of their courſes. Inſo much as ſome haue told me they had as leefe beare a childe as endure that paine; and my ſelfe haue ſeene ſome to my thinking by their deportment, in as great extremity in the one as in the other. This conſent commeth by the mediation of the ſpermaticke veines, for the left of theſe veſſels ariſeth out of the emulgent or kidny vein on the ſame ſide. The like may be ſaid of the ſimpathie between the womb the bladder and the right gut, for vpon inflamation of the wombe, as *Hippoc.* writeth in his firſt Booke *de Morb. mulier.* commeth the diſeaſe of the right gut, called *Teneſmus*, that is a vaine deſire to empty the belly, and alſo the *Strangurie*, becauſe the inflamation preſſeth both partes; ſo that neither the excrements nor the vrine can be long kept.

Betweene the kidnies & the wombe.

Betweene the bladder, the right gut, and the wombe.

This conſent is by reaſon of the vicinity or neighbour-hood of the parts, as alſo by communion. The communion is by the membranes of the *Peritonæum* which tye the wombe to theſe partes, and by their common veſſels, for from the ſame braunch of the Hypogaſtricall Veine come ſmall riuerets to the bladder, the wombe and the right gut. Neyther is the Connexion of the wombe with the ſhare-bone and the Lesk to be ouer paſſed without remembrance, which is made by two exceeding ſtrong Ligaments, for which cauſe in the ſuffocations of the matrix, we apply Cupping-glaſſes to the ſides of the Share-bones & to the Leske, that by theſe Ligaments as by certaine cords the wombe labouring vpwarde may be retracted and drawne backe.

How this conſent commeth

The Connexion of the womb.

Cupping glaſſes applied.

But aboue all other Conſents is that ſimpathy betweene the womb and the breſts which exceedeth euen admiration it ſelf, and is diuerſly manifeſted by the frequent tranſlation of humours out of the breaſts into the wombe, and out of the wombe into the breſts; by the ſignes of the wombe affected which are taken from the inſpection of the breſts; from the vſuall cures of the diſeaſes of both partes; and finally from the knowledge wee haue by the breſts of the condition of the infant yet contained in the wombe. Beſide the authority of *Hippocrates* in his Booke *de Glandulis*, we haue many examples of the firſt, that is of the tran-

The ſimpathy betweene the breſts and the womb.

How it is manifeſted.

ſlation of humors too and againe betweene theſe parts.

Blood out of the Nipples.

Amatus Luſitanus in his ſecond Century the ſecond Cure reporteth, that hee ſaw two women, who vpon the ſuppreſsion of their courſes did auoid bloode out of the Nipples of their breaſts at certaine and ſet times and returnes, imagine ſhortly after the vſuall time of their courſes. And *Hippocrates* it appeareth had ſeene the like, for hee writeth in the 40. Aphoriſme of the fift ſection, that thoſe women who haue blood gathered about their breſts are in danger to grow mad and raging. *Braſſavolus* reporteth, that hee ſaw a woman out of whoſe breſts iſſued blood in ſtead of milke; and this may well be, for we all knowe that Nurſes haue their courſes ſtopped, becauſe the blood returneth from the wombe vnto the breſts, where it is turned into milke vſually; that in this example the blood came out vnturned that was the rarity.

Milk auoided by the womb and by Vrine.

We haue ſeene alſo on the contrary many women in childebed who haue auoided by the womb and the bladder great quantities of milke. This tranſlation of humors therefore is ordinary. Somtimes the blood goeth other wayes, as I haue known

A ſtrãge thing of a Maide of Lincolnſhire

an ancient maide in Lincolnſhire, who euer about the time ſhe ſhould haue her Courſes, for many daies together hath founde in her mouth in the morning when ſhee awaked, the quantity of foure or fiue ounces of blood more or leſſe, and moſt part of it caked as it is in a Saſer after blood letting, and this continued with her for many yeares together, but hir teeth rotted fowly with it, her breath grew noiſome, and ſhe faint at thoſe times, but without any other diſeaſe.

The conditiõ of the wombe known by the breſts. *Hippocrates.*

For the ſecond, that is, that by the inſpection of the breaſts the condition of the wombe may be knowne, we will alledge onely that oracle of *Hippocrates* in the ſixt Booke of his *Epidemia* and the fift ſection. If the Nipples of the breaſt and that which is vſually red about them, grow paled or yellowiſh, then is the wombe diſeaſed.

How to ſtay immoderate Courſes.

For the third, that the cure of the affectes of theſe parts demonſtrate their ſympathie, we may remember that which *Hippocrates* hath deliuered, and is continually put in practiſe as neede requireth, viz: *If you would ſtay the immoderate fluxe of a womans Courſes, then ſet a great Cupping-glaſſe vnder hir breaſt*; for that will drawbacke the bloode by an accuſtomed way.

The breaſts ſhew the age, ſex & health of the infant in the womb.

Finally, by the inſpection of the breſts, the age, the ſexe, and the health of the Infant yet in the wombe is demonſtrated. *Hippocrates* in his Booke *de Natura pueri. As ſoone as the infant beginneth to moone, the Milke acquainteth the Mother with it, for preſently vpon the motion the breaſts ſwel, and the Nipples ſtrut out.* If therefore the breaſts bewray the time of the infants mooving then doe they alſo declare the age; for a man childe mooueth the thirde month, a maiden childe the fourth.

The Age.

And for the ſexe, *If the right breſt*, ſaith *Hippocrates* in the 38 Aphoriſme of the fift Section, *doe conſume or fall, it fore-tokeneth an abortment of a male childe; if the left of a female ſo if the right breſt ſwel and ſtrut; it is a ſigne that a male childe is conceiued, if the left a female.*

How the breſts foretell the health or ſickneſs of the Infant.

Laſt of all, the inſpection of the breaſts doth foretel the health or ſickneſſe of the infant. For if in a woman with childe the breaſts do ſuddenly fall ſwampe as we ſay, then will ſhee abort or miſcarry, ſo ſaith *Hippocrates* in the 37. Aphoriſme of the fift ſection. All theſe are moſt euident and neceſſary arguments of the conſent and ſympathy between the breſts and the wombe: but becauſe almoſt all ſimple ſympathies are made by the communion of veſſels, we will in a few wordes lay open vnto you how the veſſelles of theſe two partes doe communicate one with another, as *Laurentius* conceyueth it.

How the veſſelles of theſe parts do communicate.

The common receiued opinion.

Almoſt all Anatomiſtes do agree, that the branches of the aſcending Epigaſtrick veine, do meete in one with the branches of the deſcending Mammarie veine; and that there are in theſe branches many Anaſtomoſes or inoculations. I doe not deny (ſaith *Laurentius*) the coition or coniunction of theſe branches, but ſeeme to my ſelfe to haue found more patent, large, and nigher wayes for this communion. For the Epigaſtricke veine is not diſ-

another more likely.

perſed in his branches through the wombe, but ariſeth more commonly from a branch of the Crurall veine.

The Mamarie Veine.

Likewiſe that veine which they call *Mammaria* or the breſt veine, runneth by the inner part of the breſt-bone to nouriſh the Triangular Muſcle, neither doth it ſend any branches to the breſts vnleſſe they be very ſmall and threddy. I ſuppoſe therfore (ſaith he) that blood, milke and other humours doe flowe backe by the Hypogaſtricke and ſpermaticall Veynes

The Hypogaſtrick and ſpermaticall.

(which are proper veines of the wombe) vnto the trunke of the hollow veine, and out of it into the vein called *Axillaris* or the ſhoulder vein, from which there ariſe two notable cheſt veines called *Thoracicæ*, which do water the Muſcles of the cheſt, and the Glandules or kernels of the breſt.

On

On the other ſide, I conceiue that the milk returneth by the *Thoracicall* veines to the *Axillarie*, from it vnto the trunke of the hollow veine; from which it paſſeth ſomtimes by the ſpermaticke branch into the womb, ſometimes by the *Hypogaſtricall* partly into the womb partly into the bladder, from whence come oftentimes thoſe milky waters which wee call *Lactea*, that are made after the woman is deliuered. There is alſo a nearer way for the milk to paſſe by the wayes of the vrine through the emulgent veines.

Milky waters made after womens labour.

QVEST. XII. *Concerning the Acetabula, the hornes and coates of the wombe.*

OOncerning the endings of the veſſels in the bottome of the womb, to which the after-birth cleaueth till it be ſeuered either by the ſtrength of the Infant, or after by the dexterity of the Midwife, they are called *Acetabula* in Latine; in Greeke *Cotyledones*, which are nothing elſe but the ioyning of the endes of two paire of veines (one comming from the ſpermaticall another from the *Hypogaſtricall* braunch) with the mouths of the vmbilicall veine, and ſo making a ſumphyſis or connexion betweene the mother and the Infant.

Cotyledones what they are

The latter Anatomiſts deny that there are any ſuch conſpicuous in women, but only in Sheep and Goates: *Ariſtotle* ſayth in his 3. Booke of the *Hiſtorie* and the ſecond of the *Generation of Creatures*, they are onely to be found in horned Beaſts: we ſay. There is a 3. fould acceptation of this word *Acetabula* in *Galens* Booke of the diſſection of the wombe. Firſt they ſignifie viſible holes into which the veſſels of the wombe doe ende in faſhion reſembling the hearbe called Venus Nauill which we call in Engliſh Penny-graſſe or Hippewort. Theſe *Acetabula* are neuer found in women but in Sheep and Goates are very conſpicuous. Secondly by *Acetabula* we vnderſtand the mouthes of the veſſelles ſwelling like Nipples. And laſtly, they are the ends of the veſſels at the bottom of the wombe ioyning with the vmbilicall or Nauill veines. In this third acception no man will deny but that they are to be found in the wombe of a woman.

In what Creatures they are found.

What *Galen* meaneth by *Acetabula*.

How they are to be found in women.

Theſe mouthes of the veſſels ſayeth *Hippocrates* in the 45. Aphoriſme of the fift Section, if they be ful of mucous or ſlimy water are the cauſe of abortment, becauſe it diſſolueth the continuity or connexion of the Infant with the mother.

A cauſe of abortion.

Concerning the horns of the womb which bud out at the ſides therof, *Diocles* firſt of all men made mention of thē. *Galen* & almoſt all Anatomiſts following him do confeſſe them to be in the wombe of a woman; but the truth is, that they are only conſpicuous in Sheep, Goates, and Kine. Indeede the ſides of a womans wombe doe ſwell a little and are rayſed where the leading veſſels doe end, but not ſufficiently to expreſſe the forme of hornes or Nipples.

Of the hornes of the wombe

Laſtly, *Galen* ſeemeth to ſpeake diuerſly concerning the coats of the wombe, ſomtimes affirming it hath but one, as in the third Booke of Naturall faculties: againe in his Book of the diſſection of the wombe he ſayeth it hath two; the outward neruous, the inward venal; the outward ſimple, the inward double; but theſe places may eaſily be accorded: for wheras he ſayeth it hath but one, he vnderſtandeth the proper coate of the wombe which is the thickeſt of all the coates of the body; but when he ſayeth it hath two, he addeth to the proper a common coate comming from the *Peritonæum* or Rim of the Belly.

Of the coates of the wombe

Galen reconciled to himſelfe.

QVEST. XIII. *Of the Membrane called Hymen and the markes of virginitie*

IT hath been an old queſtion and ſo continueth to this day, whether there be any certaine markes or notes of virginity in women and what they are. Almoſt all Phyſitians thinke that there is a certain membrane ſometimes in the middeſt of the necke of the wombe, ſometimes immediately after the paſſage of the water, placed ouerthwart which they call *Hymen* This membrane they ſay is perforated in the middeſt to giue way to their courſes, and is broken or torne in their firſt accompanying with men; and therefore they call it *Clauſtrum virginitatis*, *The lock of virginity*: for which their opinion they bring teſtimonies out of the holy ſcriptures. For it was a cuſtome among the Iewes that the Brides ſhould not accompany with their Bridegroomes but vpon a ſheete, wherein the bloud ſhould bee kept, which was giuen to the Brides parents as a witneſſe of their daughters true virginity. *Falopius* yeeldeth to this opinion, *Columbus* writeth that he hath ſeene it, *Laurentius* ſayeth

What the *Hymen* is thought by ſome to be

The lock of virginity.

A cuſtome among the Iewes.

Laurentius his opinion.

that he hath cut vp mayden children borne before their time, of three moneths, of 3.4,6. and 7. yeares old, and yet hee could neuer finde it though he searched curiously for it with a Probe; which (sayth he) might haue beene felt to resist the Probe if there had beene any such thing, and therfore he thinketh that it is but a meere fable. Yet notwithstanding thus far he giueth credite to *Columbus* and *Falopius*, that hee thinketh there is sometimes such a membrane found; but if it be stretched ouerthwart in the middle or at the end of the neck of the wombe, then hee thinketh it is not Naturall, but an Organicall disease or of the instrument being faulty in conformation. So oftentimes at the very end or extremity of the lap there groweth sometimes a membrane sometimes a Caruncle or small peece of flesh, which affection or disease *Auicen* calleth *clausuram* or *the inclosure*; the Grecians call it ἐίμωσις & such women ἄπλας, that is *imperforatas*. Some are so from their infancie, some by mishap, as by an vlcer, inflamation or some other tumor against nature; but hee that will reade more of this disease let him resort to *Aetius*, *Paulus*, *Celsus*, *Albucasis* and *Oribasius* who thinketh that there is at all no such matter. Wee must therefore finde out some other locke of Virginitie. Some thinke the sides of the necke of the wombe do cleaue together in mayds and in the deuirgination are separated. *Almanzor* writeth that the necke of the womb in virgins is very narrow and rugous, & those foulds or plights are wouen together with many small veines and arteries which are broken in the first coition. *Laurentius* is of opinion that those foure Caruncles described in the history of the womb and placed not ouerthwart but longwise, doe so ioyne together in virgines by the interuening of exceeding thin membranes, that in the first coition both the Caruncles are fretted and the membranes torne, and that thence floweth the blood. This ioyning of the Caruncles *Seuerinus Pinæus* a learned Chyrurgion belonging to the French King hath notably described in a Booke which hee wrote of purpose concerning the marks or notes of Virginity, which wee also remembred before in our discourse. And thus much shall suffice to haue spoken concerning the partes of Generation both in men and women, and the Controuersies thereto be. longing.

Imperforatæ mulieres.

Aeti. Tetra 4. ser. 4. cap. 96. Paul. lib. 6 cap. 73.

Celsus lib. 7. cap. 28.

Albucasis lib. 2. Oribas. Collect. medicin lib. 24.

Honi soit que mal ypense.

The End of the Controuersies of the Fourth Booke.

THE FIFT BOOKE,

Wherein the Hiſtorie of the Infant is accurately deſcribed, as alſo the principles of Generation, the Conception, the Conformation, the Nouriſhment, the Life, *the Motion, and the Birth of the Infant, as neere as may be according to the Opinion of* Hippocrates.

The Præface.

FInding this following diſcourſe of the forming of the Infant in *Laurentius* immediately following his Hiſtory of the parts of Generation, and conſidering that it contained many things not only profitable but pleaſant alſo, I thought good (gentle Reader) to make thee partaker thereof. And the rather I heere to perſwaded my ſelfe, becauſe at the firſt ſight I conceiued that my ſelfe alſo in this *my conception* ſhold find pleaſure. But it hapneth all otherwiſe with me then it is in naturall generation, where the infant is begotten in pleaſure, though brought forth in paine. For this I aſſure thee was begotten with much paine & trauel, and if thy gentle hand help not in the birth, that alſo wil be very irkſome. I know I ſhalbe taxed by ſome for hanging too long in this argument, but I alſo know that all the Authority blame hath, is frō the Authors therof. The ſubiect of our preſent diſcourſe is the hiſtory of the Infant, of the Principles of his generation, his Conception, Conformation, Nouriſhment, Life, Motion and Birth. Verilie a knotty & ſnarled skaine to vnreele; a thicket, wherein he that haſteth with bold raſhneſſe and temerity ſhall offend & ſtumble at euery ſtep; he that is diligent ſhall entangle himſelf, and he that is guided by blinde ignorance ſhall light vpon pits and bogs; ſo that it will bee impoſsible for any man that enters into theſe Liſtes fairely to acquite himſelfe. The further he wadeth in this Riuer, the greater confluence of waters wil ouertake him, the deeper muſt he ſound if he will finde the bottome.

The argumēt of the Booke following.

We begin with the ſeed which is like the *Chaos*. Vpon which as the ſpirit of God moued whilſt it was without forme; firſt to preſerue it & after to diſtinguiſh it, ſo it is in this maſſe of ſeed; the Formatiue ſpirit broodeth it firſt. After as a Spider in the center of her Lawnie Canopy with admirable skil weaueth her Cipreſſe web, firſt hanging it by ſlender Ties to the roofe, and after knitting her enter braided yarn into a curious net: ſo the ſpirit firſt faſtneth the ſeed to the wombe with membranes and ligaments, after diſtinguiſheth it into certaine ſpermaticall threds which we call *Stamina corporis*, the warpe of the bodie. To theſe when the ſecond principle which is the Mothers blood accrueth, it filleth vp their voyde diſtances and ſo amaſſeth them into a ſolid body, which euery day is nouriſhed and encreaſed into all dimenſions, furniſhed alſo with motion, ſenſe and finally with a reaſonable ſoule. Then as impatient of ſo cloſe impriſonment, as vnſatisfied with ſo ſlender allowance, it inſtantly ſtriues till this Little world arriues into the great.

The maner of the Infantes production outof the ſeed

After we haue thus perfected the Hiſtory, we deſcend vnto the many and buſie Controuerſies depending thereupon. Theſe concerne the differences of the ſexes, the Nature of the Seed with the maner of his excretion; the qualities of the Mothers blood, the accidents hapning vnto vs there-from, with the cauſes of the monthly euacuation of the ſame; the manner of Conception as well lawful, both ſimple, double & manifold, as illegitimate and Monſtrous; the order and times of Conformation, not onely of the infant it ſelfe, but alſo of the membranes and veſſels to which it is faſtned; the Similitude of the children to theyr parents; the admirable effects of the Imagination; the cauſes of ſuperfœtation, the maner & matter of the infants Noriſhment; the admirable Vnion and communion of the veſſels of the heart; how he breatheth by Tranſpiration, not by Reſpiration; the works of his Vital & Animall ſpirits; his Scituation or poſition in the womb; and finally, the nature, differences times and cauſes of his Birth, togither with the conſequences thereof. All theſe with many more falling in with our diſputations we heere exhibit for their ſatisfaction whome they may concern, & who are more deſirous to know them, then able of themſelues to attaine thereto.

The Controuerſies conteined in this Booke.

CHAP. I.

What things are neceſſary toward a perfect Generation.

The propagation of kindes diuerſe.

THE propagation of kindes, as it is made in the Elements by Tranſmutation, and in Mettals by Appoſition, ſo it is in creatures by Generation. But of Generation there are diuers maners. For ſome creatures engender without coition onely by affrication. Others quite contrary to the ordinarie courſe of Nature, by a reception of the inſtrument of the female. Some females alſo do engender within themſelues without the help of the male. There are alſo ſome creatures which are engendred onely by putrifaction without either male or female: others are ſometimes bred out of putrifaction, other-whiles out of ſeede. But all theſe kinds of generation are maimed and imperfect, and therfore the creatures ſo procreated, are called ἄναιμα, φολεύοντα καὶ ἔντομα ζῶα vnbloodye and inſectile creatures, of which a man of worthy memory among vs, D. *Muffet* hath written a learned and curious diſcourſe, which happely time may communicate vnto the world. The Generation of man and of the perfect creatures is farre more noble, as whereto three things are alwaies required; a diuerſity or diſtinction of ſexes, their mutuall embracements and copulations, and a permixtion of a certaine matter yſſuing from them both which potentially containeth the *Idea* or forme of the particular parts of the body, and the fatal deſtiny of the ſame, & this the Grecians call μοῖραν πεπρωμένην.

Inſecta Animalia.

D. Muffet.

Three things required to perfect generation.

1 Diſtinction of ſexes.

The diſtinction of the Sexes is eſpecially neceſſary, becauſe Generation is not accompliſhed but by ſeeds which muſt be ſowne in a fruitefull ground, that is, ſhedde into ſuch a place as wherein their dull and ſleepy faculties may be raiſed and rowzed vp, which we call Conception, and afterward that which is thus conceiued, may be cheriſhed, nouriſhed, and ſo attaine the vtmoſt perfection of his kinde. But becauſe man was too hotte to performe this office (for his heate conſumeth al in him and leaueth no remainder to ſerue for the nouriſhment of the infant) it was neceſſary that a woman ſhould bee created (for wee will inſiſt now onely in mankinde) which might affoord not onely a place wherein to cheriſh and conceiue the ſeede, but alſo matter for the nouriſhment and augmentation of the ſame. Both theſe ſexes of male and female do not differ in the kinde as we cal it or ſpecies, that is, eſſentiall form and perfection; but only in ſome accidents, to wit, in temper and in the ſtructure and ſcituation of the parts of Generation. For the female ſexe as well as the male is a perfection of mankinde: ſome there bee that call a woman *Animal occaſionatum*, or *Acceſſorium*, barbarous words to expreſſe a barbarous conceit; as if they ſhould ſay, A Creature by the way, or made by miſchance; yea ſome haue growne to that impudencie, that they haue denied a woman to haue a ſoule as man hath. The truth is, that as the ſoule of a woman is the ſame diuine nature with a mans, ſo is her body a neceſſary being, a firſt and not a ſecond intention of Nature, her proper and abſolute worke not her error or preuarication. The difference is by the Ancients in few words elegantly ſet downe when they define a man, to be a creature begetting in another, a woman a Creature begetting in her ſelfe.

A barbarous conceite.

2. Copulation

The ſecond thing required to perfect generation, is the mutuall embracements of theſe two ſexes which is called *Coitus* or coition, that is, going together, A principle of Nature whereof nothing but ſinne makes vs aſhamed. Neither are theſe embracements ſufficient, vnleſſe from either ſexe there proccede a third thing, by which and out of which a newe man may bee generated. The effuſion therefore of ſeeds (which are indeede the immediate principles of generation) is altogether neceſſary, otherwiſe it were not a generation, but a new Creation. Theſe three things therefore muſt concurre to a perfect generation, a diſtinction of ſexes, their copulation, and an emiſsion of ſeede from them both.

3. Emiſsion of ſeede.

CHAP. II. *Of the Principles of generation, ſeed & the Mothers blood.*

Two principles of generation.

WHatſoeuer is generated (ſaith the Philoſopher) is begotten out of ſomwhat and from ſomvvhat; elſe vvere it as vve ſaid a nevv Creation no Generation; Wherfore the Ancients haue reſolued that tvvo principles muſt concurre to generation, Seed & the Mothers blood. The ſeed is the principle *áquo*, that is, the efficient

cient or workman which formeth the Creature and *ex quo*, that is, the matter whereof the ſpermatical parts are generated. The blood hath onely the Nature of a matter and paſſiue principle, (we therefore vſe the Schoole words becauſe they moſt emphatically expreſſe the thing) for out of this bloud the fleſhy partes are generated and both the ſpermaticall and the fleſhy are nouriſhed. The Nature of both theſe principles is very obſcure, which we will endeuour to make plaine on this manner. The Seed is called in Greek γονὴ, σπέρμα, σπόρος, in Latine *ſemen*, *Genitura*, betweene which *Ariſtotle* puts a nice difference, but *Hippocrates* takes them promiſcuouſly for the ſame. And ſo we wil call it Seed and Geniture, which we define. A body moyſt, hot, frothy and white, conſiſting of the remainders of the laſt and perfect nouriſhment and the ſpirites mingled therewith, laboured and boyled by the vertue of the Teſticles, and ſo made fit for the perfect generation of a liuing Creature. This definition doth fully and ſufficiently expreſſe all the cauſes, the formall, the materiall, the efficient and the finall.

A perfect definitiō of ſeed.

The humidity, heate, frothineſſe and whitenes do make the forme. The ſeed is moiſt δυνάμει & συσάσει, that is in Power and Conſiſtence: and therfore *Cteſias* Phyſitian to King *Artaxerxis* was deceiued, who thought that the ſeed of an Elephant was ſo dry that it wold become like vnto Amber; but it is neceſſary it ſhold be moyſt, as wel that it might be moulded by the efficient, as alſo becauſe it muſt contayne the *Idea* or ſpecificall forme of all the particles. Hot it is, that it might produce thoſe formes, for cold entreth not into generation vnleſſe it be by accident. It is frothy by the permixtion of the ſpirits and by their motion; whence it is that the Poets call Venus ἀφρόδιτη as if ſhee were made of the froth or ſoame of the ſea; and therefore ſeede when it is auoyded ſoone looſeth his magnitude, becauſe the ſpirits which houed it vp do vaniſh; whereas phlegme and other mucous matters keepe their bulke becauſe they haue little ſpirites in them. It is white, becauſe it is boyled in the Teſticles and the ſpermaticall veſſels whoſe inward ſuperficies is white, as alſo becauſe it containeth in it much ayre and ſpirits: and therfore it is but a vaine thing which *Herodotus* reporteth of the ſeed of *Negroes* or Blacke-Moores, that it is black.

The formall cauſe.

Cteſias his error.

How moyſt.

Why hot.

Why frothy.

The matter of the ſeede is double, the ouerplus of the laſt nouriſhment and ſpirits. That ouerplus is bloud, not altered and whitned in the ſolid parts as the Antients imagined, but red, pure and ſincere, deriued to the Teſticles and the preparing veſſels from the trunke of the hollow veine through the ſpermaticall veines. And hence it is that thoſe men who are very immoderate in the vſe of Venus, auoyde ſometimes bloody ſeede, yea nowe and then pure blood. Of this minde alſo is *Soranus* and therefore it is, ſayeth he, that the Antiēts called thoſe that were of a kindred *Conſanguineos.i.* of the ſame bloud, becauſe the ſeed is made of bloud, which phraſe we alſo at this day retayne. The other matter of the ſeede is that which maketh it fruitfull; to wit, thoſe Spirites which wander about the body; theſe potentially conteine the *Idea* or forme of the particular parts (for they are ayrie and moyſt eaſily taking any impreſſion) and paſſe through the ſpermaticall arteries to the mazey veſſels of the *Paraſtatæ* and the Teſticles. There they are exquiſitly mingled with the bloud, and of two is made one body, like as of that admirable complication of the ſpermaticall veine and arterie is made one veſſell.

The material cauſe double bloud.

Soranus. Why kinſmen are called *conſanguinei*.

And ſpirits.

This double matter of the ſeede *Hippocrates* expreſſeth by the names of fire and water, for ſo he ſayth ſometimes, that the ſeed is fire, ſometimes he calleth it water. It is firie by reaſon of the ſpirites which haue in them an impetuous violence or nimble agility, whence alſo it is called γονὴ πίπτουσα *ſemen turgens*, ſwelling ſeede. In reſpect of the blood which is the corpulency or bulke thereof, it is called *aqueum* watery. Both theſe *Hippocrates* in his Booke *de diæta* in one ſentence elegantly expreſſeth, where he ſayth, *The Soule creepeth into man being made of a mixture of fire and water*: By the Soule he meaneth the Seed, which therefore in other places he calleth ἔμψυχον that is Animated: by Fire hee meaneth the ſpirits and the in-bred heat which is commonly called *innatum calidum*; by *Water* he meaneth the Alimentary moyſture which is bloud. The fire ſayeth hee moueth all things through and through, the water nouriſheth all things through and through. In reſpect therefore of this double matter the ſeede carrieth the nature of both the principles of generation; of the materiall in reſpect of his craſſament or thicke body out of which as out of their proportionable matter the ſpermatical parts are generated; of the efficient and of the forme in reſpect of the ſpirits wherewith it is fulfilled. I ſayed that the ſeed was called an efficient and formall principle, becauſe the efficient and the forme are two actors in reſpect of their different operations, though indeede and trueth they are but one and the ſame. For the

Hippocrates.

How ſeed is firie.

How watry.

A hard place of *Hippocrates* explained.

How ſeed is both an efficient and materiall cauſe.

forme

forme being diffused through the matter, maketh it to be that which it is & no other thing, and it is called εἶδος the species, or ἐντελέχεια the act: but consider it as it affecteth, moueth, disposeth and worketh the matter into a proper and conuenient habitation for it selfe, and then it carrieth the nature of an efficient. The seede in respect of his bodie yssueth onelie from the vessels; but in respect of his spirits which wander vp and downe and through all, it may be sayde to yssue from all the parts of the body. This therefore is the double matter of the seede, blood and spirits.

The efficient cause of the seede.

The Efficients and authors of the seede are onely the Testicles, for the power called σπερματοποιητική, that is, of making seede, we attribute first of all and originally to the testicles. To the spermaticall vessels secondarily *per ἐπιῤῥοήν*, that is, by influence and irradiation from the testicles.

The finall cause.

The last part of the definition designeth the finall cause of the seede, to wit, the generation of a liuing creature, and the nourishment of the testicles. And thus it appeareth how this definition of seede is accomplished euery way and compleate.

Seede of two sorts. Of the Male. The Female.

Furthermore, seede is of two sorts whatsoeuer the *Peripateticks* prattle to the contrary, one of the male, another of the female; becausse in both sexes there are by Nature ordained Organs or instruments for the preparing, boyling and leading thereof; as also the same causes of pleasure and delight in the spending or euacuation. But yet the seede of the male is the first principle of generation and more actiue or operatiue; the Females the second and lesse operatiue, yet they are both fruitfull and powerfull for procreation, but neyther of them auaileable without the helpe of the other.

Two kinds of seeds in both sexes.

Hippocrates in his first Booke *de Diæta* maketh mention of a double kinde of seed in both sexes, the one strong & hot, the other weaker and colder. The first he calleth *semen masculũ* or male seede, the other *semen fœminium*, or female and fœminine seede: out of the diuers mixtion whereof, and as they ouercome one another, hee thinketh that a male or fœmale creature is generated. And thus much for the first principle of Generation, vvhich is Seede.

CHAP. III. *Of the Mothers Blood, the other principle of Generation.*

What partes are made of this blood.

THE other principle of our Generation is the Mothers Blood, to which we ascribe the Faculty of suffering onely, and not of dooing, that is to say, it is onely a principle which is wrought vpon by the seed, but it selfe worketh not in the generation of man.

Menstruall purgations.

Of this blood are the *Parenchymata* of the bowels made, as also the flesh of the Muscles; with this as well the spermaticall as the fleshy parts are nourished, doe encrease and attaine their seuerall perfections. This bloude wee thinke is of the same nature with that which at certaine times euery moneth is purged out by the wombe, in which respect *Hippocrates* first called it καταμήνιον αἷμα, that is, the Menstruous or monthly bloode.

A definition of the courses.

The Nature of this blood entangled in a thousand difficulties we will make plaine by this definition. The Menstruous blood is the excrement of the last Aliment of the fleshy parts, which at certaine times and by standing periods is in a moderate quantity purged by the wombe, but originally ordained for the Generation and Nourishment of the New creature. This definition expresseth six heads conerning the menstruall blood: the matter, the Efficient cause, the vniuersall time, the particular time, the quantity, the wayes of euacuation, and the vse which hath the nature of the finall cause.

The matter of the menstruous blood is the ouer-plus of the last Aliment. For in the nature of woman there is a superfluity more then she spendeth for many reasons. First, becausse her heate is but weake, and cannot discusse or euaporate the reliques lefte after the parts are satisfied; secondly becausse of the softnesse and loosenesse of their flesh; whence it is that a womans body is scarsely perspirable, that is, in respect of men they sweate but little. Thirdly, by reason of their course of life and order of diet. For they eate more moist meates, they vse bathing oftner, they sleepe more, and in a word their life is more sedentary and idle, at least they vse lesse exercise; for these reasons a woman among all creatures is followed with these monthly euacuations.

We call the matter of this bloud an Excrement, not that it cannot bee assimulated or is of a hurtfull or noxious quality like an vnprofitable excrement, but becausse the quantitie thereof redoundeth after the flesh of the parts is satiated and filled, and is returned into the veines and thence as an excrement vomited out by Nature offended with an vnprofitable

bur-

burden, for there is a ſatietie euen of that which is good. And this is that affluence and refluence *Hippocrates* ſpeaketh off, that tide of the blood ſometimes flowing, again ebbing ſometimes. For when the veines ſtrut with fulneſſe the hot fleſh draweth the bloud vnto it, which, when that attraction is ſatisfied and ceaſed, ebbeth againe into the veines. This blood therefore is laudable and Alimentary, and as *Hippocrates* writeth in his firſt Booke *de morbis mulierum*, floweth out red like the bloud of a ſacrifice and ſoon caketh if the women be ſound.

Hippocrates expounded.

The veines being fulfilled with theſe remaynders of the Aliment, and burdned with the wayght of the blood whoſe quantity onely is offenſiue vnto them, they ſolicite Nature to excretion. Nature, being alwayes vigilant for her own behoofe, and a true louer and cheriſher of her ſelfe, by the expelling faculty which ſhe hath alwayes at her command driueth out theſe reliques. For as a man that hath loſt one or both his legges, if hee continue that fulneſſe of dyet which hee vſed before, is often ſolicited with a great iſſue of blood by the ſiedge, becauſe the liuer ſanguifieth as much as it was wont, which yet there wants one part or more to conſume it: euen ſo and after no other manner is this menſtruall euacuation accompliſhed; by Nature not being able to diſpoſe of that plenty which by the Liuer is miniſtred.

The efficient cauſe of the courſes.

But becauſe Nature doth all her buſineſſes in order and therefore preſcribeth lawes vnto her ſelfe, ſhe doth not endeuour this excretion in euery age, at all times, nor euery day, but at ſet times and by determined periods, which ſhee of her ſelfe neither anticipateth nor procraſtinateth; that is, doth not either preuent or foreſlow vnleſſe ſhee be prouoked and haſtned before her time, or elſe hindered or interrupted at her owne time. Theſe Natural times are either vniuerſall or particular. The Vniuerſal time, all men do accord, beginneth for the moſt part in the ſecond ſeauen yeares, that is at 14. yeares olde, and endeth the ſeauenth ſeuen, that is at 49. or 50. Now the reaſon why this bloud floweth not before the 14. yeare is this, becauſe both the veſſels are narrower, and beſide the heate ouercome with the aboundance of the humour cannot expell the reliques, which after it hath gotten more ſtrength it is able to maiſter and driue as it were out of the field. Adde hereto that in the firſt yeares a great part of the bloud is conſumed in the growth of the body; and beſide before the woman is fit to conceiue, Nature doth not beſtow this matter of the menſtruall blood vpon her.

The vniuerſal time of the courſes, and the reaſons thereof.

Now at the ſecond ſeauen yeares the heate begins to gather ſtrength, to burſt foorth as the Sunne in his brightnes, and to rule in the Horizon of the body; from which heate doe proceede as neceſſary conſequencies, the largenes of the wayes and veſſelles, the motions and commotions of the humours, their ſubtilty or thinneſſe, and finally the ſtrength of the expelling faculty. At that time men begin to grow hayrie, to haue luſtfull imaginations and to change their voyce; womens Pappes begin to ſwell and they to thinke vppon husbands. After the fiftieth yeare the courſes ceaſe, becauſe the heate being nowe become more weake is not able to engender any notable portion of laudable bloud, neither yet if there be any ſuch ouerplus, is able to euacuate or expell the ſame; you may adde alſo, that Natures intention and power of procreation beeing determined; it is no more neceſſary that there ſhould be any nouriſhment ſet aſide.

Why the courſes flow at 14. yeares old.

Why they ſtay at 50.

Concerning the particular times of this monthly euacuation, *Ariſtotle* is of opinion that it cannot be preciſely ſet downe, and almoſt all learned men herein conſent with him. Notwithſtanding it is reaſonable, we ſay, to think that Nature hath ſet and determined motions and eſtabliſhed lawes, albeit wee are ignorant of them: for who was euer ſo neare of Natures counſell but that he might in ſome things erre, in ſomethings be to ſeek. Theſe times knowne to her ſelfe ſhee keepeth immutable and inviolate, vnleſſe either the narrownes of the wayes or the thicknes of the humour doe interrupt her, or elſe ſhee bee prouoked by the acrimony of a corroding quality in the bloud, or by ſome other outward prouocatiõ; to poure them forth before her owne ſtinted and limitted time. Once therefore euery moneth ſhe endeuoreth at leaſt, this menſtruall excretion, ſometimes in the full of the Moon ſometimes in the waine; and in thoſe women which we cal *viragines*, that is, who are more manniſh, for three dayes together, in others that are more ſoft, idle and delicate, ſuch as *Hippocrates* in his firſt Booke *de diæta* calleth ὑδαλώδεας, that is, wateriſh women, for a whole ſeuen-night. And againe, in the firſt Section of his ſixt Booke *Epidem.* ***In women that are wateriſh the courſes continue longer.*** In thoſe women that are of a middle and meane diſpoſition they continue foure dayes; and theſe we cal Particular times.

The particular times of the courſes. *Ariſtotle.*

The

Hippocrates. The quantity of this monthly euacuation cannot be defined. For as *Hippocrates* obſerueth in his Book *de natura muliebri*, the blood iſſueth more freely or more ſparingly according to the variety of their colour, temperament, age, habite and the time of the yeare. Thoſe women which are fayre and white haue ſuch aboundance of humour, that it iſſueth diuerſe wayes; contrary to thoſe are browne and ſwart skins which are commonly drier. In moderate and meane tempered women the quantity of the courſes is about two *Heminæ*, that is 18. ounces which is *Hippocrates* his proportion.

The wayes of the courſes. The wayes ordayned for this euacuation are the veines of the womb and the womb it ſelfe. The veines do run from the *Hipogaſtrick* and ſpermatick branches to the bottom & necke of the wombe; by the veines of the necke of the wombe it iſſueth in thoſe women which are with child, by the other in virgins and ſuch as are not conceiued, but not *per diapedoſim*, that is by tranſudation, but *per anaſtomoſim*, that is by the opening of the orificies of large and patent veines.

Why nature purgeth the bloud throgh the wombe. Now if it be asked why the blood is purged through the womb; I anſwere, it is done by a wonderfull prouidence of Nature, that the bloud being accuſtomed to make his iourney this way, it might after conception preſently accrew for the nouriſhment and generation of the Infant.

The finall cauſe of the menſtruous bloud double. Hence we gather the finall cauſe of the menſtruous bloud (which was the laſt poynt in our definition) to be double, the generation of the *parenchymata* or ſubſtances of the bowels and the fleſh, as alſo the nouriſhment and ſuſtentation of the Infant as well whileſt it is in the mothers wombe, as alſo after it is borne into the world. For howe ſhould the ſeede conceiued atteine either nouriſhment or increaſe vnleſſe this bloud ſhould be diſpoſed into theſe wayes wherein the Infant is conceiued. Afterward when it is born, the ſame blood returneth by knowne and accuſtomed waies alſo into the pappes and there is whitned into milke to ſuckle it. And this we take to be the nature of the ſecond principle of our generation, the mothers bloud or the monthly courſes.

CHAP. IIII. *Of Conception.*

The order of the acceſſe of the principles THeſe two principles of Generation, Seede and the Mothers bloud are not at one and the ſame time auoyded in coition, becauſe the ſpermaticall and the fleſhy parts are not at one and the ſame time delineated. But if the generation goe rightly on, firſt both ſexes doe affoord fruitfull and pure ſeedes which are poured out into the wombe as it were into a fertil field. Afterward when the filaments or threds of the ſolide parts are lined out, then the bloud floweth thereto as wel for the ſtructure of the *parenchymata* or ſubſtãces of the bowels, as alſo for the nouriſhment of the whole *embryo* or little Infant.

Hippocrates expounded. The man therefore and the woman ioyned together in holy wedlocke, and deſirous to raiſe a poſterity for the honour of God and propagation of their family; in their mutual imbracements doe either of them yeeld ſeede the mans leaping with greater violence. The woman at the ſame inſtant doth not onely eiaculate ſeede into her ſelfe, but alſo her womb ſnatcheth as it were and catcheth the ſeede of the man, and hideth it in the bottom and boſome thereof.

Theſe ſeedes thus caſt and drawne into the bottome of the wombe are out of hand exquiſitly mingled, otherwiſe ſayeth *Hippocrates* in his Book *de Natura pueri*, they are neither *nouriſhed* nor *animated* together. *And if any man*, ſayth he in his firſt Book *de diæta, do deny that the Soule is mixed with the Soule, let him be held for a dotard.* Now by the Soule hee meaneth the Seed, as we haue ſayed before.

Conception what it is. This mingling of the ſeedes is the firſt work or indeuour of Nature in generation. And preſently after the ſeeds are thus mingled, the womb, which is the moſt noble and almoſt diuine Nurſe, gathereth & contracteth it ſelfe, and that I may vſe the words of the Arabians is ſo corrugated that ther is no empty or void place left therein. And this it doth as being greedy to conteyne and to cheriſh, we ſay to Conceiue the ſeed. Moreouer, leaſt the geniture thus layd vp ſhould iſſue forth againe, the mouth or orifice of the wombe is ſo exquiſitly ſhut and locked vp that it will not admit the poynt of a needle. Then the wombe rowzeth and raiſeth vp the ſleepy and lurking power of the ſeeds, and that which was before but potentiall, it bringeth into act.

An action of the wombe. This action of the womb we properly call *Conception*, the Grecians κύημα or κύησις, and it is a Viuification of fruitfull ſeede to make a creature, depending vpon a proprietie of the body of the wombe.

Hippocrates

Hippocrates in his Booke *de Principijs*, and the fift Aphoriſ: hath left vnto vs ſome ſignes of Conception. Some alſo doe gather ſignes of Conception out of all the parts almoſt of the body. We thinke a woman hath conceiued, if in the confluence of their ſeedes there runneth a chilneſſe or light horror through her whole body; or if ſhe perceiue her womb to contract it ſelfe; if ſhe receiue the ſeede of man with delight and it yſſue not from her againe; if the inner mouth of the womb be exquiſitely and perfectly ſhut; if ſhe haue a light and wandering paine about her Nauell or *Hypogaſtrium*, which we call the Water courſe; if her monthly courſes do ſtop vnvſually; if her Paps grow hard, do ſwell and haue paine in them; if ſhe be not ſo fit for, or deſirous of *Venus* combats; if ſhe ſuddenly grow mery and as ſuddenly againe ſad beyond her accuſtomed manner; finally, if ſhee haue a loathing of her meate, and vſe to caſt in the morning after her bodye is a little ſtirred. But vvhether a woman be conceiued with a man or a woman childe it is very hard to iudge. Notwithſtanding, we may thus make coniecture out of *Hippocrates* in the 48. Aphoriſme of the 5. Section. She that goeth with a manchilde is well coloured, ſhe that goeth with a woman child is ſwarthy or pale coloured. Againe, in the ſame place Male children are born in the right ſide, Females in the left; & in the 38 Aphoriſme of the ſame Section. If ſhe haue conceiued a male the right pap will ſwell, if a female the left: but all theſe ſignes are rather coniecturall then carry any certainty with them.

The ſignes of Conception.

Of a man and of a Woman-child.

CHAP. V. *Of the Conformation of the Parts.*

THE Generatiue faculty which before lay ſteeped, drowſie, and as it vvere intercepted in the ſeede, being now raiſed vp by the heat and inbred propriety of the wombe breaketh out into acte, as raked Cinders into a luculent flame. Then that noble and diuine builder ſetteth vpon her worke, & buildeth her ſelfe a habitation fit for the exerciſe and performance of all hir functions. But becauſe ſhe could not performe this ſo great a worke without an organ or Inſtrument, ſhe vſeth the ſpirit, wherewith the froathy ſeede ſwelleth, as hir Painter or drawer to ſcore out and delineat all the particular parts. This ſpirit walketh through the vvhole body of the ſeede, and diffuſeth it ſelfe into euery part and portion thereof. This ſpirite is he which maketh the parts Homogenie, that is, gathereth all the particles of a kinde together, extendeth them, and as a glaſſe maker holloweth or boreth them by blowing into the. To this ſpirit *Ariſtotle* imputeth the Ordination, the Segregation, the Concretion, the Denſation, Rarefaction, and Contraction of the matter of the parts. This *Galen* in his ſecond Booke *de Semine*, calleth the framing Artizan, the begetter or the former of the parts of man. And *Mercurius Triſmegiſtus* ſaide well, that it was the ſpirit: which viuifieth or quickneth euery forme in the whole world, diſpenſing and gouerning all things according to the proper worth of each particular.

The ſpirit is the workman

Ariſtotle.

Mer. Triſmegiſt

The ſpirit therefore is the firſt and immediate inſtrument of the ſoule, diſporting it ſelfe in the bulke of the ſeede, and like a cunning Painter ſhaddowing out firſt with a rude Penſill the conformation of all parts both Similar and Organicall, the forme and Idea whereof it conteineth in it ſelfe, afterward it addeth the liuely colours, beautifying and polliſhing euery one in their due order.

This whole worke of conformation that admirable *Hippocrates*, as *Galen* witneſſeth in his firſt Booke *de Semine*, diſtinguiſheth into foure times. The firſt time is that, wherein the ſeeds mingled doe yet retaine their own forme which he calleth γονὴν, for then there is nothing to be ſeene but the ſeede coagulated or ſammed together, and couered as it wer with a fi me. The ſecond time he calleth κύημα, wherein there is a certaine rude adumbration of the parts, and as it were a fleſhy *maſſe*. The third, wherein a man may ſee the repreſentation of the three principall parts, the Braine, the Heart, and the Liuer, together with the firſt threds and as it were the warp of all the ſpermaticall parts, and this conſtitution of the creature he calleth ἔμβρυον. The fourth and laſt time wherein there is a perfect ſeparation, diſcretion and deſcription of all the parts, and then he calleth it παιδίον ἤ κοῦρον, the childe or the Infant. This ſurely is an excellent diſtribution, but for thoſe that are rude ſuch as wee intend to informe a great deale too darke and obſcure. We will therefore endeuour our ſelues more manifeſtly to ſhew vnto you the whole proceſſe of Nature in the conformation of a man, and in what order all the parts are at firſt orderly delineated.

The Conformation diuided into four times.

Whilſt the ſpirit, the inſtrument of the ſoule, beginneth to work vpon the maſſe of ſeed which to ſee to is vniforme, but indeed full of Heterogeny or different parts; Firſt of all it ſeuereth

seuereth the parts which are vnlike one another; the thinner more noble and better furnished with spirits it hideth within; the thicker, colder and clammier which most part are supplied by the mothers seede, it compasseth about the former. At these cold and viscid parts of the Seede it beginneth the conformation, for of them it maketh membranes, and streatcheth them out in breadth according to Natures vse and intent, shewing therein her admirable prouidence. For with these as it were with defences the more noble part of the seede is walled about and secured; the inward spirites concluded or imprisoned which otherwise because of their tenuity would easily vanish. Adde farther, that if the membranes had not first beene made, the tender *Embryo* and the principall partes thereof would haue suffered offence from the hardnes of the wombe.

First the membranes.

For euen as God in the great world hath separated the fire from the earth by the interposition of water and ayre, so in the *Microcosme* or Little world, the Nature of man imitating the grand Architect hath separated the Infant from the wombe by the interposition of these membranes. But the Nature of these membranes is not all one in Beastes and in men. For in Beastes, especially such as haue hornes, we haue obserued three membranes called *Chorion*, *Amnion*, & *Allantoidem*. That we call *Chorion* cleaueth wholly to the womb by the interposition of the vmbilicall veines and arteries, and in this membrane are to bee seene those *Cotyledones* wouen of a fleshy and spongy substance. The second membrane called *Amnios* is thinner then the former, this compasseth round about the Creature and is thought to bee the receptacle of the sweate. The third is called *Allantoides*, because it is much like that we call a Haggas pudding, for it doeth not encompasse all the Creature but only from the Breast-blade to the Hips, and may be compared to a girdle or broad swathe, and is sayed to contayne the vrine of the creature whilest it is in the womb. In a man there are onely two membranes to be found, the first and the second called *Chorion* and *Amnios*. The *Chorion* is neruous and strong, & encompasseth the Infant roūd whence haply it hath his name, either because it compasseth it as a circle or crowne, or because it is *fœtus* χώρημα, the conceptacle of the Infant, or because it supplyeth nourishment vnto it, for somuch χορηγεῖ foundeth.

In Beastes 3.

In men two. *Chorion.*

This membrane like a soft boulster or pillow susteyneth and supporteth all the veines and the vmbilicall arteries; for it was not safe that the vesselles of the Infant issuing out of his Nauill should go so long a iourney naked without defence. In them are not as in bruit beastes those *Cotyledones* or knubbes like the Teates of the Breast, but onely a fleshy masse made of infinite branches of veines and arteries wonderfully implicated or wouen togither and filled vp with blood which supplyeth the place of these *Cotyledones*. The later writers call it the cake or Liuer of the wombe, and some *orbicularem affusionem* the round affusion. Whose vse is as another Liuer to prepare and boyle the bloud for the nourishment of the Infant. We do rather call this round and red body like the orbe of the Moone when it is at the full, which cleaueth onely to one part of the wombe and doth not wholly encompasse the Infant; πάγκρεας or καλλίκρεας the Sweete-bread of the wombe, and doe assigne vnto it that vse that the Sweete-bread hath in the lower belly, to wit, safely to support and as a pillow to beare vp the vmbilicall vesselles diuersly sprinkled through the *Chorion*. But it may be demanded why an Infant hath not those *acetabula* or *Cotyledones* to tye the *Chorion* firmly to the wombe as it is in beastes: happely because a woman doth not bring forth so many young as beastes doe; or because the wombe of a beast swelleth more outward, and therefore could not beare their burthen vnlesse it had beene fastned with stronger tyes.

Why in women the *Cotyledones* are not found.

The vse of the cake.

The other coate which immediatly encompasseth the Infant, from the softnes and thinnes thereof is called ἀμνειὸς the Lambs-skinne: others call it the shirt, and the Arabians *Abigas*. It is loose on euery side vnlesse it be at the place of the cake, where it groweth so fast to the *Chorion* that it can hardly be separated; and this coate receiueth the sweate and the vrine from whence the Infant hath no small help, for it swimmeth as it were in these waters or is couched in them as it were in a bath: beside, it maketh the birth more facile and easie because it moystneth the orifice of the wombe and maketh it more slippery.

Amneios.

His vse.

These coats growing one to another seem to make but one couering, which the greeks call ὕστερον καὶ ὑστερον, the Latines *fœcunda* or *fœcundina*, either because it issueth last out of the womb in the birth, or because it is a second habitation for the Infant, the womb being the first, we call it commonly the after-birth.

The after-birth.

The inner or more noble part of the feede being secured by these membranes or coats, more bloudly vndertaketh the forming of the parts. At that time therefore the spirite walketh

keth through the whole body of the ſeede, and becauſe there are two faculties aſsiſtant to the procreating faculty, that is to ſay, the Changing and the Forming: therefore firſt of all the ſeede is altered or changed and diſpoſed, then almoſt in the ſame inſtant the firſt threds of the ſpermaticall partes are together and at once skored or ſhaddowed out with rude lines.

Then are to be ſeene three bubbles or cleare drops ſuch as the raine rayſeth when it falleth into a riuer, which are the rudiments of the three principall parts, & beſide a thouſand ſtrings which are the warp, as it were, of the veſſels and the ſpermaticall parts. So that it is very likely that thoſe oracles of *Hippocrates* in his firſt Booke *de diæta*, and in his Booke *de locis in homine* are moſt true, where he ſayeth, that all the parts are inchoated or begun together, but doe not appeare neither are perfected at once but by degrees. But at what time whether the fift or the ſeauenth day, all theſe begin to be figured, hee only the Creator who maketh the Infant knoweth, and none elſe. Yet if we will relye vpon *Hippocrates* authority or vpon our owne experience, which is very tickle, we may ſay, *That the ſeauenth day the ſeede hath what ſoeuer the body ought to haue*, that is as I interpret it; the ſeuenth day doe appeare the rudements of all the ſpermaticall partes, which alſo your eye may diſcerne if you caſt the maſſe into fayre water and then diligently view it. Theſe foundations of the ſpermaticall parts being thus layed, euery one is after accompliſhed in their owne order, firſt thoſe that are moſt noble and moſt neceſſary, as the three principall partes, the Brayne, the Heart and the Liuer, and the veſſels to them belonging, nerues, arteries and veines. The veines are propagated from the Liuer euen to the *Chorion*, and to the ſame membrane are deriued arteries from the *Iliacall* branches, and doe ioyne with the mouths of the veſſels of the wombe, ſo that theſe vmbilicall veſſelles by which the Infant draweth his breath are the of-ſpring of more inward veſſels contrary to the common opinion of the vulgar Anatomiſts.

The foundations of the parts are layd at once.

3 bladders. *Hippocrates.*

The 7. day the parts are deliniated.

What parts are firſt formed.

The harder and more ſolide parts are figurated together, but not together perfected. For of the bones ſome are ſooner perfected ſome later. The ribbes, the lower iaw, the ſmal bones of the eares, the patell or choler bones, the bone *hyois*, are all bones euen from the firſt originall. The bones of the arme, the legge and the thigh haue their heads imperfect and meerly griſtly; the bones of the vpper iaw, of the hands, of the whole ſpine & the rump are nothing elſe at the firſt but griſtles.

Their order.

The cauſe of the more ſpeedy forming or perfecting of any part is to bee referred to the vſe thereof, that is, to the neceſsity of the finall cauſe; and therefore the ribbes becauſe they make the cauity of the Cheſt are at firſt made bony, leaſt otherwiſe the bowelles ſhould be compreſſed. The lower iaw was very neceſſary inſtantly after the birth of the Infant for his ſucking and other motions. The ſmall bones of the eares that they might reſound the better needed be dry and hard. The patell or coller bones were neceſſarily made ſtrong at the firſt, becauſe they tye the arme and the ſhoulder blade to the trunke of the body; as alſo the bone *hyoids* to eſtabliſh the toung. And thus may we make eſtimation of the other parts; in the delineation whereof the forming quality perpetually laboureth, neuer reſting till it haue made an abſolute ſeparation and deſcription of them all. This is performed in male children the thirtiteh day, and in females the 40. or the 42. day. So ſayth *Hippocrates* in his Booke *de Natura pueri*, and *de ſeptimeſtri partu*. *A woman child hath her conformation at the fartheſt the two and fortieth day, and a man child at the fartheſt at the thirtieth.*

The cauſes of this order.

At what times the conformation is accompliſhed.

This is the firſt conformation of the Infant made onely of the body or ſubſtance of the ſeede, which the creature exceedeth not in magnitude. For ſayeth *Ariſtotle* in his ſeuenth Booke of his Hiſtory of Creatures and the third Chapter, if you caſt the *Embryo* into cold water it will not appeare bigger then a great Piſmyre; but I, ſayth *Laurentius*, haue often ſeen an Infant of 40. dayes old, as long as a mans little finger.

There is another conformation of the Infant of the other principle of Generation, that is of bloud, of which the fleſhy parts are framed, as the ſpermatical are of ſeed. This bloud floweth through the vmbilicall veine, which is a branch of the gate veine filling the emptie diſtances betweene the fibres.

The ſecond conformation from the bloud.

But whereas there are three ſorts of fleſh; that which groweth to the bowels they call παρέγχυμα; that which adhereth to the fibres of the muſcles they call abſolutely fleſh; and the third is that which is proper to euery particular part. This threefold fleſh we ſay is not generated together and at once but in order: firſt the *Parenchymata*, next the fleſh of the particular partes, and laſt of all the fleſh of the muſcles. Of the *Parenchymata* the firſt that

3. ſorts of fleſh.

The order of this conformation.

is formed, is that of the Liuer, because the vmbilicall veine first powreth out the bloode thereinto; then the *Parenchyma* of the heart, then those of the other bowels. And this is the manner and order of the conformation of the infant, and of all the parts thereof.

CHAP. VI. *Of the Nouriſhment of the Infant, and how it exerciseth the Naturall Faculties.*

AS in the workes of Art men do proceed from that which is leſſe perfect to that which is more perfect; right ſo is it in the works of Nature. Wherfore the tender *Embryo* liueth firſt the moſt imperfect life, that is, the life of a Plant which we call the Vegitatiue life. Afterward growing vnto further ſtrength, it attaineth the life of an vnreaſonable creature which we call the Senſatiue life, and laſt of all the moſt perfect life of a man when it is enduced with a reaſonable ſoule. This *Ariſtotle* teacheth in his firſt Booke *de Generatione Animalium* where he ſaith, *the Infant is not made a liuing Creature and a man together.* But we muſt vnderſtand that this progreſſe in perfection commeth not by reaſon of the forme, becauſe that is ſimple and cannot be diuided, but by reaſon of the matter, that is, of the Organes, which that noble forme and *firſt acte* vſeth for the accompliſhment of ſecond Acts as wee call them, and all the functions.

Three kindes of life.

Ariſtotle.

The firſt life of the creature whereby it liueth from the very beginning of the Conception, is the moſt ſimple; and is maintained without that which wee properly call Nouriſhment. And indeede what neede was there of Nouriſhment or reſtauration where there was no exhauſtion or conſumption of the parts? The *Embryo* at firſt hath ſufficient to cheriſh it ſelfe out of it owne heate, and by it owne inbred ſpirit. But after the parts are diſtinguiſhed and delineated, then preſently it beginneth to be nouriſhed and encreaſed, yet is not this nouriſhmenr of the ſame kind with that which the infant enioyeth after it is ariued into the worlde. For then it ſucketh Aliment by the mouth, but whilſt it is in the wombe it receiueth it onely by the Nauell, whatſoeuer *Democritus* and *Epicurus* ſay. And that did *Hippocrates* not obſcurely intimate, when he ſaide in his Booke *De Alimento*, ἡ δὲ ἀρχαιοτέρη τροφὴ διὰ τῦ ἐπιγαστρίου ὀμφαλοῦ. that is, *The firſt Nouriſhment is the Nauel through the Abdomen.* After it is borne it ſwalloweth into the ſtomacke meats of all kinds, before (ſaith *Hippocrates* in his Booke *de Natura pueri*) it draweth onely of the pureſt bloode from the Mother, which is transfuſed into the Liuer. The Infant after it is borne maketh manifolde changes and alterations in the Aliment: firſt *Chylification*, then *Sanguification*, laſtly *perfect Aſsimulation* which is the third concoction. When the infant draweth pure bloode, it giueth not thereto any forme or faſhion, but only a perfection and temper like vnto it ſelfe. Wherfore we aſcribe to the infant not Chylification nor Sanguification, but onely the third concoction which is the particular Nouriſhment of the ſingular parts. The manner of this thirde and onely concoction in the infant conteined in the wombe, is thus.

Two kinds of Nouriſhing

One only action in the nouriſhment of the Infant.

The infant being tied by the mediation of veſſels and Membranes to the Mothers womb, draws the pureſt of her blood through the mouths of thoſe veſſels inoculated one into another after a wonderfull manner. This blood thus drawn is powred into the body of the Liuer through the vmbilicall veine, which is a branch of the gate-veine, and reacheth to the Fiſſure of the Liuer, yea you may often in dead bodies followe a probe out of it into the ſmall veins of the Liuer: Here the blood is more and more perfected, afterward the thicker and more crude part is diſtributed through the roots of the Gate-veine into the ſtomacke, the ſpleene and the kidneys, the excrements and reliques wherof by the Splenick & meſenterick branches are abligated into the cauity of the guts, and there are by degrees gathered together, and in their abode are ſo dried that they become thick and blacke. The purer and better concocted part of the bloode is conueyed into the trunke of the hollow veine, from which it is diffuſed through the whole body by the veins, as it were by ſmal riuerets. But becauſe the blood is not without his whey, which ſerueth to weſt it through the ſmal Veines, therefore the whey hauing performed that his office is partly ſpent in ſweate by the habite of the body, partly it is drawne by the Kidneys, and ſo tranſcolated through the Vreters or Vrine veſſels into the bladder. For the conteyning of which ſweate and Vrine, Nature appointed the Membraue called *Amnios*. Yet we muſt not thinke that the Infant piſſeth his vrine into this Membrane by the priuities, but it is conueyed thereinto thorough the *Vrachos*, which is a long and bloodleſſe Canale or pipe lengthened from the bottome of the Bladder vnto the Nauell. Neyther hath it any Muſcle thereto belonging, becauſe in

The true way how the Infant is nouriſhed.

The excrements of the Infant where beſtowed.

The vſe of the *Vrachus.*

the

the Infant no time is vnſeaſonable for the auoyding of theſe excrements; whereas when we auoide our vrine, we haue Muſcles at the roote of the yard, to ſtay or to further that euacuation that it might not be performed but in conuenient time, and at our beſt leiſure as before is ſaide.

CHAP. VII. *How the Infant exerciſeth his vital Faculties.*

THE Infant alſo liueth in the wombe farre otherwiſe then hee liueth after he is borne; for neither is the Cheſt diſtended and contracted, becauſe hee draweth not his breath by his mouth, neither doth hee engender any vitall ſpirits becauſe he draweth them from his Mother: neither laſtly dooth hee neede the motion or worke of the Heart or the Lungs, but the heate of the perticular parts is cheriſhed, preſerued and refreſhed onely by Tranſpiration and the pulſation of the Arteries.

The diſsimilitude of the life of the Infant before & after birth.

This different life hath alſo a different ſtructure, ſubſtance, and vſe of the vitall organes, which becauſe it hath not beene knowne to any of the Anatomiſts of this our age; albeit it was firſt of all diſcouered by *Galen* in his ſixte and fifteenth Bookes of the Vſe of Partes, though obſcurely, we will endeuour to make it as manifeſt and plaine as poſsibly we can.

Galens wonderful Obſeruation.

In the *Baſis* of the heart, that is, in the broad end, there appeare foure notable veſſelles, two in the right ventricle, the Hollow veine, and the Arteriall veine, and two in the lefte, the great Artery, and the venall Artery. The vſe of theſe after we are borne is this. The Hollow veine which gapeth with a wide mouth into the heart, powreth the bloode into the right ventricle as it were into a wide Ciſterne, there it is reboyled and attenuated as well for the generation of vitall ſpirits, as alſo for the nouriſhment of the Lungs. A parte therefore of it ſwetheth through the middle wall betwixt the ventricles into the left ventricle. Another part is carried by the arteriall veine into the thin, rare, and ſpongy ſubſtance of the Lungs. The Venall Artery leadeth into the left Ventricle the aer which wee breath in, prepared before in the Lungs where it is mingled with the blood, of which permixtion the vitall ſpirits are generated. This ſpirite the heart driueth into the trunke, and ſo into branches of the great Artery. In the infant before birth all theſe things are otherwiſe, and a farre other vſe is there of all the veſſels.

The Vſe of thoſe Veſſells after birth.

The vſe of the veſſels before the Infant is borne.

For the hollow veine doth not poure this ſtreame of blood into the right ventricle, becauſe neither the Lungs ſtand in need of attenuated blood, being at that time all of the red, thicke, and immooueable, neither is there any generation of vitall ſpirits. The venall artery leadeth not the aer into the left ventricle, becauſe the infant doeth not breath by the mouth, but onely hath vſe of Tranſpiration. The great Artery receiueth no vitall ſpirites from the heart, but by the vmbilicall arteries: and therefore the Arteriall veine dooth not the office of a veine but of an Arterie, for it carrieth onely vitall ſpirits, but no bloode. Againe, the venall artery doth the office of a veine, containing onely thick and hie coloured blood for the nouriſhment of the Lungs. But becauſe there was no paſſage from the Hollow veine to the venall Artery, Nature ioyned theſe two veſſels (which doe but touch one another) by a large and round hole through which the bloode hath free paſſage from the Hollow veine, to the venall Artery.

How the Veſſels of the hart are vnited.

To this hole ſhe hath alſo ſet a thin and cleare Membrane like a couer, which ſhoulde giue way to the blood ruſhing out of the Hollow vein, but ſhould prohibit it for returning againe thereinto. As alſo that by means of this Membrane, the hole after birth when there is no more vſe of it, might ſooner bee ſouldered vp, hauing a principle of conſolidation ſo neere and ready at hand. And becauſe the arteriall veine and the great artery were diſtant a little ſpace each from other, ſhe hath ioyned them by a third pipe or Canale of the Nature of an artery running aſlope betweene them, that ſo the vital ſpirite might paſſe freely from the great artery into the arteriall veine.

The wonderfull reſiccatiō of the paſſagesafter birth

This is that admirable vnion of the veſſels of the heart in the infant vnborn, to wit, of the hollow veine with the venall artery, and of the great Artery with the arteriall veine; but the ſhutting vp and reſiccation of theſe veſſels within a few dayes after the birth, that is indeed beyond all admiration. For that large hole vvhereof vvee ſpake, is ſo cloſed that there remaineth no footſteps or ſigne of it. As for the third arteriall pipe or Canale, vvithin a fevv daies it vvithereth and ſhrinketh together, and at length it grovveth ſo ſmall that no man would beleeue there vvere any ſuch thing.

Hence it may bee concluded that the Infant in the wombe draweth his mothers ſpirites by the vmbilicall arteries, and liueth contented onely with the pulſation of the arteries, not at all needing the help or motion of the heart.

CHAP. VIII. *Of the motion and ſcituation of the Infant in the wombe, which are Animall faculties.*

Why the Infant moueth not the firſt 3. months.

THE Soule being an ἐντελέχεια or act of an Naturall organicall body, doeth not nor cannot performe her functions without a conuenient organ or inſtrument. Wherefore in the firſt monethes the tender Infant by reaſon of the weaknes of the Brayne and ſoftneſſe of the ſinewes is not able to moue his members. But when the bones begin to gather ſtrength, and the nerues, membranes and ligaments, which before were full of a mucous and ſlimy humour begin to dry, then the Infant kicketh and moueth.

When the motion begins. *Hippocrates.*

The firſt beginning of this motion ſayeth *Hippocrates* in his Booke *de Natura pueri*, and *de morbis Mulierum*, is in Male children at the third moneth, in Females at the fourth: ſo that there is a certaine and definite proportion of the conformation and the motion of the Infant, and a double time comming betweene them. Male children therefore becauſe they haue their conformation the thirtieth day doe mooue the ninetieth, now the 90. day maketh vp the third moneth. Females becauſe they haue their conformation the two & fortieth day, they are mooued the hundered and twentyeth, which fulfilleth the fourth moneth.

The Infants motion voluntary.

This motion of the Infant is not Naturall but voluntary, as beeing perfourmed by the helpe of the Muſcles contracting themſelues. The muſcles are contracted becauſe the Soule ſo commaundeth. This commaundement is carryed by a corporeall Spirite and conuayed thorough the Nerues; which Spirte is daylie generated in the *Sinus* of the Braine or in his ſubſtance of the Vitall, which the Infant receiueth from the vmbilicall Arteries.

The ſcituation of the Infant.

To this mooving faculty wee muſt alſo referre the ſcituation or poſition of the Infant in the wombe. For ſo *Hippocrates* in his *Prognoſtickes* referreth the poſition or manner of lying of the ſickeman, eyther prone that is downeward, or ſupine that is vpward or on either ſide, to the weaknes and ſtrength of the mouing faculty.

The natural ſcituation. *Hippocrates.*

The Naturall ſcituation of the Infant is thus deſcribed by *Hippocrates* in his Booke *de Natura pueri*. *The Infant as he is placed in the wombe hath his hands at his knees, and his head bent downe to his feete.* Wherefore he ſitteth in the wombe crumpled, contracted or bent round, holding his knees with his hands and bending his head betweene them, ſo that each eye is fixed to the thumbe of either hand, and his noſe betwixt his knees.

Figura media what it is.

This Figure though it bee not exquiſitely the meane or middle poſition as wee call it, that is ſo Naturall as that all the partes are in their due poſition; yet it commeth neareſt thereunto, and therefore is neither paynfull nor weariſome to the Infant; and for the mother very conuenient becauſe thus the Infant taketh vp the leaſt roome, and beſide riſeth not ſo high that it ſhould preſſe or beare vp the midriffe or the ſtomacke, as we ſee in ſome women vvhen their burthen lyeth high they are ſhort breathed and much more vnvvealdy as vve vſe to ſay.

The reaſon of the poſition.

Moreouer this poſition is moſt fit for the eaſie birth of the Infant, for lying thus vvith his head betvvixt his legges, vvhen he ſeeketh meanes to get out, he is ſooner turned vvith his head dovvnevvard to the orifice of the vvombe, vvhich manner of trauell is of all other the eaſieſt and moſt ſecure, both for the Infant and the mother, as ſhall better appeare in the next Chapter.

CHAP. IX. *The excluſion or birth of thr Childe.*

THE tender and ſoft particles of the Infant being now all perfected and eſtabliſhed hee becommeth euery day greater and hotter, and requireth more nouriſhment, and being now not contented onely with tranſpiration, deſireth and ſtriueth after a more free vſe of the ayre.

Now when as the mother is not able to ſupply vnto the Infant either the ayre whereby it liueth in ſufficient quantity through the narrow vmbilical arteries, or other

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nourishment by the vmbilicall veines, whereby it might be supported and refrigerated, the Infant then as it were vndertaking of himselfe a beginning of motion, striueth to free himselfe from the prison and dungeon wherein he was restrayned; kicking therefore hee breaketh the membranes wherein he was inwrapped, and arming himselfe with strong violence maketh way for his inlargement with all the strength and contention that he may.

This contention and distention the wombe ill brooking, and besides being ouerburthened with the waight of the Infant now growne, striueth to lay downe her loade, and with all her strength by that expulsiue faculty wherewith she is especially furnished she rowzeth vppe her selfe, and with violence thrusteth her guest out of possession of his true inheritance. The causes of a womãs deliuerance.

Thus the ioynt strife and as it were consent betwixt the Infant and the wombe bringeth to light a new man, not vppon his feete, nor side-long, but as diuine *Hippocrates* hath foreshewed ἐπὶ κεφάλην, that is head-long, so be his out-gate be naturall. The reason is, because the vpper parts which hang vpon the nauel string as at the beame of the ballance, do ouerway the neather. In what manner the Infant is borne.

Furthermore, this strife and contention of the Infant and the wombe is assisted by the voluntary endeuor of the woman in trauell, which is by drawing in her breath and by that meanes bearing down the midriffe: adde hereto the skilfull hand of the head-woman or Midwife as we cal them, for she setteth the woman in a due posture or position of parts, receiueth the Infant gently which falleth from betwixt her knees, directeth it if it offer it selfe amisse; and finally draweth away as easily as is possible the after-birth which stayeth behinde.

Here *Galen* in his 15. Booke *de vsu partium*, breakes out into an admiration of the immortall God; for the mouth or orifice of the womb, which in the whole time that the burthen was carried, was so exquisitly closed vp, nowe enlargeth it selfe to that extent that the body of the Infant passeth through it. *Galens* admiration at the prouidence of God.

This birth hath no certaine or limitted time in man as in other creatures, but hapneth vncertainly at any time of the yeare: the reason is, because other creatures haue set times of copulation, but man because the propagation of his kinde was most necessary, is not tyed to any time or season, but left to the liberty of his appetite and guidance of his discretion. Adde hereto; that other creatures in their coitions are glutted and more then satisfied: man (I know not how) hath his appetite encreased euen in the fruition of that which hee affecteth. Other creatures vse alwayes one and the same manner of diet, which may be a bridle and restraynt: Man wandreth wantonly through infinite varieties of viands and delicates whereby he is goaded and prouoked to intemperate lust. I forbeare to speake of the power of those fancies, lustful imaginations and passions wherby euery houre as by so many furies he is racked and tormented: all which we know are of great auaile to alter the body of man. The time of trauel vncertaine.

The times of the birth of man are the 7.8.9.10. and eleuenth monethes. The seauenth moneth is the first time, because before it an Infant cannot be borne aliue into the world, neither indeede is such an exclusion properly called a birth, but an abortment. The eleauenth moneth is the last time and vtmost limit, which whosoeuer exceedeth, is deceiued in the time of her conception, and the Cat we say hath eaten her marke. The middle months are the nine and the tenth. The time of mans birth.

By a moneth we meane with *Hippocrates* that which they call *mensis solaris*, that is to say thirty dayes. Nor that birth which we cal *Septimestris*, or *Nonimestris*, or *Decimestris*, each fulfill seauen or nine or ten whole and compleate monethes: for wee knowe that there is a great latitude of the seuenth and tenth moneth, so that the Infant that is born in the beginning or middle or end of the seuenth month is truely called *partus septimestris*. The beginning of the seuenth moneth *Hippocrates* designed in his Booke *de septimestri partu*, where he sayeth that those Infants which wee call *septimestres* are brought into the world within an hundred and fourescore dayes and a peece of a day. The end of the seuenth month hee limitteth in his Booke *de principiis*, where he sayth that the *Septimestris partus* is circumscribed within thirty weekes, that is two hundred and ten dayes; for 7. times 30. amounteth to that number. *Hippocrates.* *Septimestris partus* what it is.

The Infants called *Octimestres*, that is, such as are borne the eight moneth do neuer liue, vnlesse happely in Egypt, because the heauen and the soyle are there most gentle and benigne. The birth at nine moneths is most legitmate and to Nature most familiar. In the

tenth month trauell is not so vncouth, in the eleuenth most rare.

But why the seuenth month and the ninth should bring forth liuing Infants not the eight, the *Pythagorians* do refer to the power and efficacy of Numbers, the *Geometricians* to the duplicated proportion of the conformation and the motion, and the triplicated proportion of the motion to the birth. The *Astrologians* refer it to the diuerse and different Aspects of the Planets and Stars. But these are meere toyes.

Why the Infant borne the 7. month suruiueth.

The Physitians vppon better grounds haue found out certaine and established rules of Nature and her ordinary Circuites and Returnes, which vnlesse she be interrupted or prouoked, she neuer either hasteneth or foresloweth. Wherefore seeing the infant in the seuenth month becommeth perfect, not wanting any accomplishment of his parts, if at that time he haue strength sufficient, he breaketh the Membranes and worketh out his passage, liuing and suruiuing because he is perfect, especially if it be a male childe.

The Physitians reasons.

But in the eight moneth if he be borne, albeit he haue the perfection of his parts, yet he suruiueth not, because he is not able to endure two instantly succeeding afflictions (as we call them) or contentions; for the seuenth month being now perfected he laboureth sore and striueth for his enlargement. If therefore being weakened by that strift he againe returne to labor before he be refreshed, it is impossible he should hold out or suruiue so great expence of strength and spirits but must needs sink and faile.

Furthermore, at the eight moneth the Infant doth not liue, because he commeth after the day of birth which should haue been in the seauenth month, and before the day which is to be the ninth.

Why the viii. month the infant liuethnot

Whereupon we gather, that some euill accident hath betided him, which eyther hath hindred his birth the seauenth month, or preuented his stay till the ninth. But because these things are somewhat obscure, we referre you for further satisfaction to the Controuersies next ensuing, wherein we will labour to assoile not onely this difficulty, but also all others which may arise concerning the difference and temper of the Sexes, the Nature and Effusion of the seede, the quality and causes of Excretion of the Mothers bloode, the Lawfulnesse and Errors of Conception, the manner and time of Conformation, the Growth and encrease of the Infant, and how it exerciseth the Naturall, Vitall and Animall Functions; and finally, concerning the Nature, Differences, Times, and Causes of the Birth.

The subiect of the Controuersies following.

¶ A Dilucidation or Expositon of the Controuersies concerning the Historie of the Infant.

QVEST. I. *Of the Difference of the Sexes.*

The necessity of the distinction of the sexes.

Aristotle in his Bookes of the History and Generation of creatures, doth often inculcate that the difference of Sexes is most necessary vnto perfect Generation, which is also sufficientlie proued by the Finall cause the most noble of al the rest, mouing the other causes it selfe remaining immoueable. For as in the seede of a Plant, the power of the whol tree is potentially included and contained, which notwithstanding neuer breaketh into acte, vnlesse that acte be stirred vp by the heate of the earth; Right so, the seeds of the Parents conteyning in them the Idea or forme of the singular parts of the bodie, are neuer actuated, neuer exhibite their power and efficacie, vnlesse they be sown and as it were buried in the fruitfull Fielde or Garden of Nature, the womb of the woman.

It

It was therefore neceſſary that there ſhould be a double creature, one which ſhoulde beget in another, and another that ſhould generate in it ſelfe: the firſt we call a Male, the ſecond a Fœmale.

The Male is originally the hotter, and therefore the firſt principle of the work, and beſides affoordeth the greateſt part of the formatiue power or faculty. What the Male is.

The Female is the colder, and affoordeth the place wherein the ſeede is conceiued, and the matter whereby the Conception is nouriſhed and ſuſtained, which matter is the crude and raw remainders of her owne aliment. What the Female is.

The place is the wombe, which by a naturall diſpoſition looſeneth the bondes wherein the ſpirit of the ſeede is fettered, and withall helpeth to adde vigour and efficacie therunto. For if the ſeede ſhould be powred into any other part of the body it would not be Conceyued but putrified; not preſerued, but corrupted.

The matter whereby the ſeede is nouriſhed is the Mothers bloode. The Excrement of the laſt aliment of the fleſhy parts.

This difference of the Sexes do not make the eſſentiall diſtinctions of the creature: the reaſons are: Firſt (becauſe as *Ariſtotle* ſaith in his ſecond Booke *de Generatione Animalium* and the 4. chap. and in his 4. Booke *de Hiſtoria Animalium* and the 17. chapt.) in all creatures there is not this diſtinction or diuerſity of Sexes. Secondly, becauſe eſſentiall differences do make a diſtinction of kinds: now we know that the Male and the Female as both of one kinde, and onely differ in certaine accidents. But what theſe accidentall differences are is not agreed vpon as yet. The difference of Sexes is not eſſentiall.

The *Peripatetiks* thinke that Nature euer intendeth the generation of a Male, and that the Female is procreated by accident out of a weaker ſeede which is not able to attaine the perfection of the male. Wherefore *Ariſtotle* thinketh, that the Woman or female is nothing elſe but an error or aberration of Nature, which he calleth παράβασις by a Metaphor taken from Trauellers which miſſe of their way and yet at length attain their iournies end; yea he proceedeth further and ſaith, that the female is a bye worke or preuarication, yea the firſt monſter in Nature. *Ariſtot.* Error.

Galen in his 6. and 7. chapters of his 14. Booke *de vſu partium*, following *Ariſtotle* ſomething too neere, writeth, that the formatiue power which is in the ſeede of man being but one, doth alwayes entend the generation of one, that is, the Male; but if ſhe erre from hir ſcope and cannot generate a male, then bringeth ſhe foorth the female which is the firſt and moſt ſimple imperfection of a male, which therefore he calleth a creature lame, occaſionall and acceſſary, as if ſhe were not of the mayne, but made by the bye. *Galens* Error.

Now heerein he putteth the difference betwixt her and the Male, that in males the parts of generation are without the body, in Females they lye within becauſe of the weakeneſſe of the heate, which is not able to thruſt them foorth. And therefore he ſaith, that the neck of the wombe is nothing elſe but the virile member turned inward, and the bottome of the wombe nothing but the *ſcrotum* or cod inuerted.

But this opinion of *Galen* and *Ariſtotle* we cannot approue. For we thinke that Nature aſwell intendeth the generation of a female as of a male: and therefore it is vnworthily ſaid that ſhe is an Error or Monſter in Nature. For the perfection of all naturall things is to be eſteemed and meaſured by the end: now it was neceſſary that woman ſhould be ſo formed or elſe Nature muſt haue miſſed of her ſcope, becauſe ſhee intended a perfect generation, which without a woman cannot be accompliſhed. Diſprooued.

Thoſe things which *Galen* vrgeth concerning the ſimilitude, or parts of generation differing onely in ſcite and poſition, many men do eſteeme very abſurd. Sure we are that they ſauour little of the truth of Anatomy, as we haue already prooued in the Booke going before: wherein we haue ſhewed how little likeneſſe there is betwixt the necke of the womb and the yard, the bottome of it and the cod. Neither is the ſtructure, figure, or magnitude of the teſticles one and their ſame, nor the diſtribution and inſertion of the ſpermatick veſſels alike, wherefore we muſt not thinke that the female is an imperfect male differing onely in the poſition of the genitals. No ſimilitude betwixt their Genitals.

Neither yet muſt we thinke that the Sexes do differ in eſſentiall forme and perfection, but in the ſtructure and temperament of the parts of generation.

The woman hath a wombe ordained by Nature as a Field or ſeed-plot to receyue, conceiue and cheriſh the ſeed; the temper of her whole body is colder then that of a man, becauſe ſhe was to ſuggeſt and miniſter matter for the Nouriſhment of the Infant. And this How the Sexes are diſtinguiſhed.

way

way *Aristotle* in the second Chapter of his first Booke *de Generatione Animalium* seemeth to incline, where he sayeth that the Male and the Female doe differ as well in respect as in sence: In respect, because the manner of their generation is diuerse; for the Female generateth in her selfe, the Male not in himselfe but in the Female: In sence, because the partes appeare other, and otherwise in the Sexes. The partes of the Female are the wombe and the rest which by a general name are called *matrices*; the parts of a man are the virile member and the Testicles. And so much shall be sufficient to haue beene added concerning the difference of the Sexes. But because there is more difference of the Tempers in men and women, we will insist somewhat more vpon that point.

QVEST. II. *Of the Temperament of women, whether they are colder or hotter then men.*

CONcerning the Temperament of men and women there is a notable controuersie, which if I may take vppon mee to censure or arbitrate, I will briefly acquaint you with what I haue gathered concerning this matter, out of the fountaines of the Grecians, and Cisternes of the Arabians.

There are some which thinke that women are hotter then men: others on the contrary, that men exceede women in heate by many degrees: Neither of these opinions want patrons to defend them, nor reasons to sustaine and support them.

That women are hotter then men. *Hippocrates.*

If the *Edicts* of *Hippocrates* our *Dictator* doe stand for a law, as truely they deserue well to doe, then shall mens part goe to the wall; for in his first Booke *de morbis mulierum*, hee playnly auoucheth that women are hotter then men, his words are these. *I say that the flesh of a woman is more rare then that of a man.* Nowe rarity with the Phylosophers is the worke of heat, to wit, his secundary quality; as it is the property of cold to condense or thicken: so it is the property of heate to rarifie or make thin. Againe in the same place hee sayeth that the body of a woman draweth more suddenly and more aboundantly the moysture out of the belly, then the body of a man.

Now wee know that sudden and aboundant traction is not accomplished without the help of notable heate, and therefore it is that *Hippocrates* in his 6. Section of his 6. Booke *Epidemion* calleth *carnes attractrices*, because they are very hot. Finally, let vs see what *Hippocrates* inferreth vpon this rarity of the flesh and strong attraction of moysture. *The woman hath hotter bloud, and therefore is hotter then a man*; what cold hee say more playnely? what more determinately?

Reasons for this opinion.

Of the same opinion was *Permenides* as *Aristotle* reporteth in the second chapter of his second Booke *de partibus Animalium*. But let vs see how this opinion of *Hippocrates* may be established by reason.

The first.

The Temper of the whole body is to be esteemed according to the Temper of the principall parts, especially of the heart and the Liuer; and this we haue from *Galen* in his Book *de Temperamentis*, and *de Arte parua*, where he sayeth: *Those whose heart is hot, are also of a hot habite of body*, vnlesse there bee some obstacle in the Liuer; and those that haue hot Liuers haue also hot habits vnlesse there be some repugnancie in the Heart. But if both these bowels doe conspire in the same Temper, then of necessity must the Temper of the whole body be like vnto them; but the Heart and the Liuer of women are hotter then of men; and therefore their whole bodies are also of a hotter temper then mens.

A womans heart hotter then a mans.

That the heart of a woman is hotter then the heart of a man may thus be demonstated, the Temper of the particular parts is especially known by the strength of their action; now the actions and faculties of the heart are two, *vitall* as say the Physitians, and θυμώδης, or *Irascibilis*, that is, the passion of anger as say the Platonists. Both these are more operatiue & liuely in a woman then in a man. The vitall faculty shyneth most euidently in the pulse.

Now the pulses of women are more quicke and frequent, of men more rare and slow as *Galen* teacheth in the 9. Chapter of his Booke of pulses *ad Tyrones*, and in the second chapter of his third Book *de causis pulsuum*. That also *Auerroes* affirmeth in the fourth *Colliget*: and the 19. Chapter. But the frequency and swiftnesse of the pulse bewrayeth the strength of the heate; for as it is the property of colde to make the partes sluggish and dull in their motion; so heate moueth them continually, and giueth them no rest at all.

Women sooner angry then men.

The other faculty also of the heart which we called *Irascibilis* or the passion of Anger, we many of vs know by woefull experience to bee quicker and more vigorous in woemen then in men, for they are easily heated and vpon very sleight causes; but Anger with *Galen*

in

in his Booke *de Arte parua* is a signe of a hot heart. Hence it is that females are more bold and cruell then males. For Hunters affirm, that of Tygers, Beares and Lyons, the females are farre fiercer then the males.

The Liuer of a woman hotter then of a man.

That the Liuer of a woman is hotter then a man may bee prooued by the same demonstration. The Naturall Faculty which hath his residence in the Liuer, and is diuided into the encreasing, nourishing and procreating vertues, is stronger in a woman then in a man. For we see that wenches grow faster then boyes, become sooner ripe, and yeeld seede the sooner, which is the worke of the generatiue Faculty; they are also more wanton and lasciuious, as hauing the Testicles hid within their bodies, by which they are heated. For *Galen* saith, that the Testicles after the heart, are as it were another hearth of Naturall heate.

The procreating Faculty.

The Nourishing Faculty.

The Nourishing Faculty, which is a certaine signe of the heat of the Liuer, is more perfect in a woman then in a man, for their liuer engendreth more blood, now so much blood as we haue, so much heate haue we also. Neither is this blood of theirs of any hurtfull or ill quality, but onely offensiue in quantity. Beside the habit of women is more fat, plumpe and delicate to see to and to feele, and altogether without haires.

The Animall Facultyes.

Finally, in women all the Animall Faculties are most perfect, their senses most sharpe, their Muscles more nimble and deliuer to mooue their ioynts, their memories more happy, their inuention more subtile, their words, which expresse the conceit of the mind, more plentifull and abundant, and therefore *Virgil* expressing the communication of the Gods, makes *Iupiter* begin, and *venus* to answere, but addeth:

Aenei. 10.

Iupiter hæc paucis, at non Venus aurea contra
Pauca refert.
Thus in few words did *Iupiter* his royal sentence end,
But *Venus* faire in many more did thus her cause commend.

If therefore all the Faculties, Vitall, Naturall and Animall, are in women more perfect then in men, who will deny but they are also hotter then men? Neither will we passe ouer in silence that which *Macrobius* hath obserued in the 7 Book of his *Saturnalia*, *What time the bodies of men were burnt, to euery ten men they put the body of a woman, to make them the sooner take fire.*

Macrobius. Saturnal.

That men are hotter then women.

These things are indeede probable, and couered ouer with a veile of trueth, which notwithstanding if we weigh in the ballance of Philosophie and of Physicke, they will appeare to be as light as vanity it selfe; we will therefore maintaine the other opinion, that men are generally hotter then women. And this we will confirme by strong and substantial reasons, as also by the authority of the best and most authenticke Authors.

The places from which the arguments are fetched.

There are very many things which will euince this truth, but these among the rest. The Principles of Generation; the Place in which, and out of which the Infant is generated; the Conformation; the Motion; the time of Birth; the Purgation after Birth; the Structure and Habit of all the parts; the manner of Diet and course of life: And finally, the Finall cause. All which we will briefly run through.

The principles of Generatiō.

If we consider the Principles of Generation, Men are generated of hotter seede then women. This hath *Hippocrates* elegantly declared in his first Book *de diæta*. For acknowledging a double or twofold kinde of seede in both Sexes, a Male seede and a Female, he concludeth that of the male seede, that is the hotter and more vigorous, a man is generated; out of the weaker a Woman. Moreouer, men are generated in a hotter place, *Hippocrates* in the 48. Aphorisme of the fift section, saith, Male infants are borne on the right side, females on the left. now we know that the right side is hotter then the left by reason of the Liuer. For the heart is indifferent and in the very middest, especially the Basis thereof which is the hottest part.

The place of Conception.

Neither are Males generated onely in the right side, but also out of the right side. For so saith *Hippocrates* in his Bookes *Epidemion*; when a man begins to grow lustfull, if his right Testicle swell, he will beget a manchilde, if his left a woman. And thence also it is that he calleth the right Testicle *Masculū* the male, and the left *Fœminium* the Female, because the seede of the one is very hot and exquisitly boyled and made of the purest blood, that of the other colder & thinner, hauing much whey in it because of the originall of the left spermaticall veine out of the emulgent. This the Countreymen know full well, and therfore when they would haue Cow-calues, they tye the right Testicle of the Bull, that the seed may only yssue from the left; which they learned or might haue done from *Hippocrates* in his book

The place out of which the Infant is conceyued.

De

De ſuperfœtatione, where he ſayeth, *When you would engender a Female, tye the right Teſticle of the Male, when a Male tye the left.*

The conformation. If wee reſpect the τύπωσις or conformation of both the Sexes, the Male is ſooner perfected and articulated in the wombe; for he is accompliſhed the thirtieth, the Female not before the 40. day, as wee haue before noted out of *Hippocrates* in his firſt Booke *de diæta, de natura pueri* and *Epidemion*: but conformation is the woorke of heate. So likewiſe the Male is moued ſooner that is the third moneth, the Female later that is the fourth beſide the motions of the Male are more frequent and more violent, all which are manifeſt ſignes of an aboundant heate. Adde hereto that the Male borne the ſeuenth moneth commonly ſurviueth, the Female ſeldome or neuer.

The *Lochia*. That alſo which is auoyded after the Infant is borne into the world called *Lochia* doeth teſtifie the heate of a Male childe: for the woman which is diliuered of a Female is longer in her purgations, of a Male ſhorter, becauſe the Male being hotter ſpendeth more of the bloud gathered together in the wombe. This *Hippocrates* teacheth in playne tearmes in his Booke *de morbis mulierum*: *After the birth of a mayde* (ſayeth hee) *the longeſt purgation laſteth 42. dayes, but after the birth of a knaue childe* (ſo our Fathers called a Male) *the purgation laſteth at the longeſt but 30. dayes.*

The habit and ſtructure. If we conſider the habite and ſtructure of the parts of both Sexes, you ſhall finde in men more ſignes of heate then in women. The habit of a woman is fatter, looſer and ſofter; but fat is not generated but by a weake heate, woemen are ſmooth without hayre. The fleſh of men is more ſolide, their veſſelles larger, their voyce baſer: now it is heate which amplifieth and enlargeth, as cold ſtraightneth and contracteth.

A woman ſayth *Hippocrates* in the 43. Aphoriſme of the ſeauenth Section, is not *Ambi-dextra*, that is, cannot vſe both hands as well as one, becauſe ſhe wanteth heat to ſtrengthen both ſides alike.

The diet. In diet alſo, that is, in the cuſtome and vſage of their liues in meat and drink and ſuch like, men appeare to be hotter then women.

Hippocrates in his firſt Booke *de diæta. Men doe liue a more laborious life, and eat more ſolide meates then women, that they may gather heate and become dryer, woemens foode is more moyſte*; and beſide, they liue an idle and ſedentarie life, pricking for the moſt part vppon a clout.

The finall cauſe. Finally, to all theſe we may ad the neceſsity of the Finall cauſe which is in Natural things the chiefe of all cauſes: It behoued therefore that man ſhould be hotter, becauſe his body was made to endure labour and trauell, as alſo that his minde ſhould bee ſtout and inuincible to vndergoe dangers, the onely hearing whereof will driue a woman as wee ſay out of her little wits. The woman was ordayned to receiue and conceiue the ſeede of the man, to beare and nouriſh the Infant, to gouerne and moderate the houſe at home, to delight and refreſh her husband foreſwunke with labour and well-nigh exhauſted and ſpent with care and trauell; and therefore her body is ſoft, ſmooth and delicate, made eſpecially for pleaſure, ſo that whoſoeuer vſeth them for other doth almoſt abuſe them.

Concluſion. Wherfore we conclude, that if you reſpect the principles of Generation, the place, conformation, motion, birth, purgations after birth, the habit of the whole body, the ſtructure of the parts, the manner and order of life, and the finall cauſe of Creation, you ſhall finde that in all theſe reſpects a man is hotter then a woman.

Authorities to proue men hotter. If our aduerſaries will not yeelde to all theſe demonſtratiue arguments, let them at leaſt giue credance to the whole Family of the Grecians both Philoſophers end Phyſitians.

Hippocrates. This *Hippocrates* before the birth or incarnation as we may ſay of Philoſophy, with a diuine ſpirit declareth, not darkely and obſcurely but in playne tearmes in his firſt Booke *de diæta*, after this manner: *Generally and vniuerſally men are hotter and dryer then women* (for we inſiſt vpon mankind) *and women moyſter and colder then men.*

Ariſtotle. That Genius and interpreter of Nature, *Ariſtotle* in his Booke of the *length and ſhortnes of life*, ſayth, *that men liue longer then women becauſe they are hotter.* In his third Booke *de partibus Animalium*, men are ſtronger and more couragious. In the firſt and eight Chapters of the firſt Booke of his Politicks, men in all actions are more excellent then women; ſurely becauſe of their heate from whence commeth the ſtrength of the faculties. And in the 29. Probleme of the 4. Section, he enquireth why men in winter are more apt for Venus and women in ſummer, hee anſwereth, becauſe men who are hotter and dryer are in Summer ſpent as it were and broken; and women in winter becauſe they are cold and moyſt & haue little ſtore of heat,

haue

haue their humors as it were frozen or curdled, not fluxible and moouing.

Galen in a thousand places establisheth this truth, but especially in the sixt chap. of his 14. Booke *de vsu partium*, where hee saith that women are more imperfect then men, because they are colder. For indeed of all qualities heate is the most operatiue. Conclusion.

Hence therefore we conceiue that it is manifest to all men that list to vnderstande the truth, that men are vniuersally hotter then women, and that those that maintaine the contrary are Apostataes for the ancient and authenticke Philosophy. But because wee may seeme not fully to satisfie men by our reasons and authorities, vnlesse we answere the arguments brought and vrged on the contrary part, we wil a little paine our selues and the Reader to answere them in order.

To begin therefore with the authority of *Hippocrates*, because it is a kind of wickednesse not to subscribe vnto this Father of Physicke, we will thus interpret the force of his words. Answer to the authorities.

Whereas therefore he saith, that a woman hath a rarer kinde of flesh then a man, we answere, that he vseth the word Rare abusiuely or at large for that which is laxe and soft, not for that which is porous. For if we so vnderstand it, the body of a man is more rare, that is more porous and open, and therefore they sweate more freely and more easily. And that this is *Hippocrates* meaning we appeale vnto himselfe in his Booke of Glandules, where hee saith; *It is therefore manifest, that the Chest and Paps, and the whole body of a woman is laxe & soft.* And a litle aboue, *A mans body is ful & like a cloath, thicke and thight both to see to & to feele to, but a woman is rare, and laxe, and moyst, both to see to and to feele to.* Nowe laxity argueth a defect of heate which is not able to boyle and dissolue the superfluous moisture; on the contrary solidity and fastnesse of the flesh ariseth from the perfect assimulation of well boiled and resolued Aliments. Wherefore seeing the flesh of men is faster then that of the woman, it followeth necessarily that they are also hotter. *Hippocrates* pounded.

And whereas *Hippocrates* saith, that women draw more aliment then men. Hee also abuseth the word *Traction* for that which is to *receiue* and *conteyne*. For the bodye of a woman being looser and as it were spongye, receyueth and conteyneth a greater quantity of blood. And that this is *Hippocrates* meaning, I gather from the Context of the place cited. For he illustrateth his opinion by an elegant similitude. If (saith he) you lay out all night vpon the ground the like waight of wooll, and of a well wouen cloath; you shal find in the morning the wooll to waigh heauier then the cloth, because it hath sucked vp more moysture: so it is reasonable that the lax and loose flesh of women doth receiue & retaine a greater quantity of blood then the fast flesh of a man. An excellent Similitude.

And whereas in the same place he saith, that the bloode of a Woman is hotter then the blood of a man, and therefore a woman is of a hotter temper then a man; that we thinke is crept into *Hippocrates* text, being added by some nouice scribe. And thus that great Learned man *Ludouicus Duretus* vnderstandeth *Hippocrates* and conceyueth of this corrupted place; as also *Christopherus a Veiga* in his Commentaries vpon *Hippocrates* Prognostiques. Wherefore we cannot admit of *Cordæus* his interpretation, who thinketh that the bloode suppressed, because transpiration is hindred, attaineth an outward and Aguish heat, and so becommeth hotter then the blood of men. For then wee must needes accuse *Hippocrates* of folly, (which were a kinde of blasphemy) because he compareth a sick woman with a sound and haile man. But if you compare the blood of both sexes diseased, the heat of a man wil certainly be more intense then that of a woman, because it is ioyned with siccity. Now siccity (saith *Auerrhoes*) is the File of heate: And thus we suppose that wee haue satisfied the authorities out of *Hippocrates*. Now let vs waigh the arguments with as much diligence as we may. A place of *Hippocrates* corrupted. *Duretus.* *Vega.* *Cordæus* interpretation of the corrupted place reiected *Auerrhoes.*

VVomens pulses are more frequent and swift therefore they are hotter; for the swiftnesse or frequency of the pulse commeth from heate. We answere, that their pulses are more quicke and frequent, not because of the aboundance of heate, but because of the straightnesse of their organes. For the Arteries beeing small and narrowe, and oppressed with aboundance of crude and colde humours, could not bee so extended and dilated as in men; wherefore the necessity of life maketh recompence in the quicknes and frequency of the pulse; Nature prouiding for her selfe one way, when she cannot another. But the pulses of men are strong & great by reason of the strength of the faculty, because a great Artery may be extended into all dimensions. Answer to the former Arguments. Why Women haue quicke Pulses.

That which is obiected concerning the two faculties of the heart, the *Irascible* and the courage we thus dissolue: In *Hippocrates* and *Galen* ἐξυθυμία and θυμὸς, that is *Iracundia* and

Ira

Ira, Anger and Wrath are two distinct things. Anger is a disease of a weake mind which cannot moderate it selfe but is easily inflamed, such are women, childeren, and weake and cowardly men, and this we tearme fretfulnesse or pettishnes: but Wrath which is *Ira permanens* belongs to stout heartes, and therefore *Homer* calleth *Achilles* Anger: μῆνιν.

Homer.

Iliad. α. Μῆνιν ἄειδε θεὰ Πηληϊάδεω Ἀχιλῆος, &c.
O Goddesse sing the fixed rage of Peleus wrathfull Sonne.

Galen. And *Galen* in his second Commentarie vppon the first Booke *Epidemion* opposeth ὀξυθύμους *Iracundos*, angry men, θυμώδεσι to wrathfull men; becuse these latter are of a manly courage and contemners of base things, the former are faint harted or white Liuered as we vse to tearme them. And the Temper of these two sorts is very different; for those that are angry, pettish, fretfull or wantle, chuse you which you will call them, are cold; but those that are wrathfull are hot. If therefore women are Nockthrown or easily mooued of the hindges, that they haue from their cold Temper, and from the impotencie and weaknes of their mind, because they are not able to lay a law vpon themselues.

Galen interpreted by *Hip* And whereas *Galen* in his Booke *de arte parua* maketh ὀξυθυμία to be a signe of a hot hart, he abuseth the word. For *Hippocrates* in the fourth Section of the sixt Booke *Epidem.* maketh it a signe of a cold habit in expresse words, where he sayeth, *Those that haue hot bellies haue but cold flesh, such are thinne and veynie, and* ὀξυθυμόλεροι, that is, *angry or fretfull.* Women therefore are peuish creatures most-what, but nothing stout or strong hearted though their stomacks be good. *Hippocrates* in his Booke *de morbis virginum* hath this saying ἀθυμόλιρη φύσις ἡ γυναικεία, *The Nature of a woman is to be of an abiect minde.*

Why females are fierce. And whereas they contend, that among rauenous Creatures the Females are most fierce, we say that the loue they beare to their yong addeth spirits and courage vnto them, and therefore that is rather to be accounted woodnes then fortitude. There are some creatures which because of their giddy madnesse make a shew of generosity, as the Female Elephant: some also there are in whome the feare of a worse condition begetteth boldnes, such are Panthers. In a Dogge partly his trustinesse to his maister partly his enuy maketh him fierce. Wee say therefore that Females are more churlish and fierce, but not stouter or stronger hearted. That which is obiected concerning the strength of their naturall faculties is of all the rest the most friuoulous and veine.

Why women grow faster & be ripe sooner then men. They say that women grow faster and doe sooner generate, and therefore they are hotter; but we say, that these are demonstratiue signes of a cold temperament. For therefore they grow faster and ingender sooner, because their end is nearer, for that the principles of their life are weaker. For as a short disease which we call *acute*, doth suddenly run through his foure times; the beginning, the encrease, the height, and the declination so that one time ouertaketh another; so women being of a shorter life then men, because they are colder, they sooner grow women and so also sooner grow old then men. And hereto subscribeth *Aristotle* in the sixt Chapter of his 4. Booke *de generatione Animalium* where he saith, *That all things that are lesse and weake as well in the works of Art as of Nature, doe sooner attayne vnto their end.*

Why females are lasciuious That Females are more wanton and petulant then Males, wee thinke hapneth because of the impotencie of their minds; for the imaginations of lustfull women are like the imaginations of bruite beastes which haue no repugnancie or contradiction of reason to restraine them. So bruitish and beastly men are more lasciuious, not because they are hotter then other men, but because they are brutish. Beastes do couple not to ingender but to satisfie the sting of lust, wise men couple that they might not couple.

That womens Testicles are hidden within their bodies is also an argument of the couldnes of their Temper, because they want heate to thrust them forth. Yet for all this we doe not say that women do generate more then men, for they want the matter and the spirite. Indeede they haue more bloud as wee sayed euen now, and that is by reason of their colde Temperament which cannot discusse the reliques of the Aliment; adde heereto that the blood of women is colder and rawer then the bloud of men. We conclude therefore that vniuersally men are hotter then women, Males then Females, as well in regard of the Naturall Temper, as that which is acquired by diet and the course of life.

But now I had need heere to Apologise for my selfe for speaking so much of womens weaknes, but they must attribute something to the heat of disputation, most to the current and streame of our Authours, least of all to mee who will bee as ready in another place to

flou-

flouriſh forth their commendations as I am here to huddle ouer their ntaurall impetfections.

QVEST. III. *What Seede is.*

HAuing thus diſcourſed of the difference of the Sexes the firſt thing neceſſary to Generation, it followeth that we intreat of the Seede which is the immediate matter of the ſame. To this common place we may wel giue the ſame Epithite which *Homer* was wont to giue to thoſe places which were ſcituated vnder mountaines, which hee calleth πολυπίδακες, that is, hauing many ſprings of liuing water. For I doubt not but the Reader ſhall find it ful of pleaſure and contentment, ful of variety and of pleaſant philoſophicall flowers, eſpecially if I can acquit my ſelfe wel in gathering them, and if they looſe not their verdure and ſauour now tranſplanted into a ſtrange ſoyle. That I may therefore take euery thing in order, it will not be amiſſe firſt to informe you what the worde it ſelfe in the originall ſignifies.

The names of ſeed.

Γονὴ καὶ σπέρμα, *ſemen* and *genitura*, Seede and Geniture, among Phyſitians are taken for one and the ſame. *Hippocrates* intituled his Book of Seed περὶ γονῆς. And *Galen* his περὶ σπερματος. And *Hippocrates* in many places of the ſame Booke calleth it alſo σπέρμα, as where hee ſayeth καὶ ἔστιν ἐν τῷ ἀνδρὶ τὸ θῆλυ σπέρμα καὶ τὸ ἄρσεν, καὶ ἐν τῇ γυναικὶ ὁμοίως. *There is as in a man ſo in a woman Male and Female Seed.* And *Gal.* in his Comentary vpon the 62. Aphoriſme of the firſt Section σπέρμα ὀνομάζομεν καὶ γονὴν καὶ γόνον, *We call Seede Geniture.* *Hippocrates* alſo for the ſame vſeth θορὸς in his ſecond Booke *de Morbis.* But *Galen* in his Commentarie in 1. *Prognoſt.* diſtinguiſheth betweene θορὸς and σπέρμα, where he ſaith that θορὸς ſignifieth rather *the excretion of Seed.* *Ariſtotle* in the 18. Chapter of his firſt Book *de Generatione Animalium*, putteth a difference betweene *Geniture* and *Seede*, as if *Geniture* were *ens imperfectum*, an imperfect thing, and onely one principle of Generation, but *Seede* perfect, compounded of both principles. For our part we will take them promiſcuouſly, although the name of ſeed be more frequent and in more ordinary vſe.

Hippocrates. *Galen.*

What θορὸς is.

Ariſtotle.

The Nature of Seede no man that I know hath yet eſſentially defined; *Hippocrates* in his Booke *de Genitura* calleth it, *The beſt and ſtrongeſt part of that humour which is contayned in the whole body.* *Pythagoras*, The froth of the beſt and moſt laudable blood. *Plato*, The defluxion of the ſpinall marrow. *Alcmaon*, A ſmall portion of the Brayne. *Zeno Criticus* The ſpirit of a man which he looſeth with moyſture, and the ſlough of the Soule. *Epicurus* A fragment of the Soule and the Body. Some of the Antients haue defined it to be, *A hot ſpirit in a moyſture able to moue it ſelfe and to generate the ſame out of which it iſſueth.* *Ariſtotle* ſayeth it is *an Excrement of the laſt Aliment of the ſolide parts*; ſometimes he calleth it *a profitable Excrement.* *Fernelius* deſcribeth it on this manner: *It is that out of which originaly are made all thinges which are according to Nature, not as out of a matter, but as out of an Efficient Principle.* But it ſeemeth to vs that none of all theſe do ſufficiently expreſſe the nature of Seede. The fiue firſt are moſt imperfect, and therefore we will not contend with them.

Hippocrates. *Plato.* *Alcmaon.* *Zeno Criticus.* *Epicurus.*

A definition of the antients.

Ariſtotle. *Fernelius.*

Ariſtotles deſcription defineth onely the matter, which is the remaynder of the laſt Aliment; but the forme and the efficient cauſe it toucheth not; neither indeede doeth it expreſſe the whole matter of Seede, becauſe as we ſhall ſhew anone there is a double matter of Seede, bloud and ſpirits. So that to ſay that Seede is an excrement of the laſt Aliment, is all one as if he ſhould haue ſayed Seede is Blood. *Fernelius* definition contayneth neyther the forme nor the matter of Seede, but attributeth to it onely an operatiue or efficient dower, whereas it is alſo a materiall principle: wherefore we haue here exhibited another definition perfect we hope and abſolute in all his members and parts which is this.

All diſalowed.

Seede is a moyſt ſpumous or frothy and white body, made of the permiſtion of the ſurpluſage of the laſt Aliment and of the influent or errant ſpirits boyled and laboured onely by the vertue of the Teſticles, and that for the perfect Generation of a Creature. We already in this Book a little before examined the ſingular particles of this definition, which we ſhall not therefore need to run ouer againe; here we will onely proſecute a little more curiouſly the matter of Seede.

A perfect definition of ſeede.

We therefore ſay that there is a double matter of Seede, the Excrement of the laſt Aliment, and Spirits. That this firſt matter is an excrement, *Ariſtotle* prooueth by an elegant nduction, on this manner. VVhatſoeuer is contayned in the body eyther is a part of the body, or an Aliment, or a colliquation, or an excrement: Seede is not a part of the body,

The matter of ſeede double.

It is no part. nor an Aliment, nor a Colliquation, and therefore an Excrement. It is not a part, becauſe whilſt it remaineth in vs there is nothing made of it, neither hath the body any vſe eſpecially of the matter of it. Add heereto, that if it were a part ſo often as it is loſt the creatures ſhould become maimed.

No Aliment. No Colliquation. It is not an Aliment for then it ſhould not be auoyded, much leſſe is it a Colliquation. For a Colliquation is a thing beſide Nature, ſeede is truly naturall yea the quinteſſence of the Nature of man. Thoſe things that are fat are moſt ſubiect to Colliquation or melting, but we know that fat men haue leaſt quantity of ſeede. Moreouer Colliquation may bee made of any moiſture in any part of the body, but the ſeede hath his owne determinate & limited ſeate wherein it is contained. Colliquation is alwayes hurtfull, but the auoyding of ſeed is ſometimes very profitable.

But an excrement. It remaineth therefore that ſeede muſt needs be an excrement. But what manner of excrement is it? In all creatures that bring foorth their young aliue there is a double excrement. The one naturall and profitable, the other vnprofitable. The firſt is profitable either to noriſh ſome part, or to procreate, conceiue and breed vp the young, as *Galen* teacheth in his Commentary vpon the 39. Aphoriſme of the fift Section; the other cannot bee aſsimulated becauſe it is of a diſsimilar ſubſtance. The firſt is called an excrement onely by reaſon of the abounding quantitie thereof. The ſecond is noxious and hurtfull euen in qualitie alſo.

Excrements double.

What is a profitable excrement. The Chylus which is made in the ſtomacke is acceptable euen to the ſtomacke which is pained about the concocting thereof, but at length it is thruſt downe into the gut as an ouer-plus or ſuperfluity; ſo that which was an excrement to the ſtomacke becommeth to the Liuer an Aliment. The Liuer being ſatisfied and glutted with blood, driues that which remaineth as a ſurpluſage into the great veines, ſo the excrement that is, the ſuperfluity of the Liuer, becommeth a conuenable aliment for the particular parts.

How euerie part miniſtereth to another out of his owne abound-dance. The parts both fleſhy and ſolid when they are ſatisfied with blood, do leaue that which remaineth in the veines; theſe reliques are by little and little drawne by the Teſticles and at length are conuerted into the nature of ſeede. And for this cauſe the ſeede is called an excrement of the laſt concoction, becauſe it is generated out of the remainders of the laſt Aliment. That remainder is blood, not changed or whitened by the ſolid partes, for the ſeede hath his whiteneſſe onely from the ſpermaticall veſſels and the Teſticles; but redde and pure blood deriued from the trunke of the Hollow veine into the ſpermaticall veines.

How ſeed becomes white. An argument heereof is, becauſe children and decrepit old men do not yeeld ſeed, for that in theſe there is no ouerplus left, and ſuch wantons as doe too immoderately ſatisfye theyr inordinate concupiſcence do often yeeld bloudy ſeed, becauſe it is not altered hy the ſpermaticke veſſels and the teſticles.

The ſecond matter of the ſeede. There is another matter of the ſeede far more noble which maketh it prolificall or fruitfull, and that is ſpirits brought vnto it by the ſpermaticall arteries; which being fierie & aery ſubſtances wandering and courſing about the whole bodye doe containe in themſelues the Idea or forme of the particular parts. Neither do theſe ſpirits only cõteine the forme of the ſexes, but alſo τὴν πεπρωμένην μοῖραν, the fatall neceſsity of life and death; ſo that from whence we haue the acte of life, from thence alſo we haue the neceſsity of diſſolution.

In regard of theſe ſpirits the ſeede is called an efficient and a formall principle. For the ſpirit is the immediate and proportionable inſtrument of Nature, wherby the noble Architect, that is the ſoule, extendeth the Membranes, produceth and lengtheneth the paſſages, and by a kinde of puffing ſuffiation perforateth them.

The double Nature of ſeed. This therefore is the double matter of ſeede, blood and ſpirits. Hence it is that among the Philoſophers the ſeede is eſteemed to haue a double Nature; one aery, ſpumous or frothy, another wateriſh and diffluent. For in that the ſeed is aery it is neuer congealed or frozen, and in that it is wateriſh, it is no ſooner out of his owne veſſels but it melteth the ſpirits being vaniſhed which did vnite his parts.

How ſeede & water differ. *Ariſtotle.* Now, whereas there are ſome which affirme that ſeed is onely wateriſh, becauſe the colour is like water, as alſo the conſiſtence when it hath bin but a little time out of the veſſels; we will againſt them oppoſe *Ariſtotle* who diſputeth this very point in the ſecond chapter of his ſecond Booke *de generatione Animalium*, where he ſaith, that the natures of water and ſeede are very different, for water by heate becommeth not thicke as ſeede doth. All wateriſh things by colde are congealed, ſeede is made more fluid. And in the 51 Problem of the firſt Section he ſaith, that ſeede is like to Flegme and water, not in Nature but onely in colour.

lour. But we proceede.

This double matter is mingled in these Labyrinths in which the vein openeth into the artery, and the artery into the veine by a wonderfull inoculation, so that of two there becommeth one vessel; an Embleme of the holy mixtion of seedes in Matrimony. For as of two vessels a veine and an artery there is made one vessell, so of a double matter blood and spirits there is made one seede, and of two seeds the Males and the Females one infant, and of two parents the husband and the wife one body. But we returne.

How the double matter is mingled.

An Embleme of Matrimony

The blood and the spirits being thus mingled do attaine in the preparing vessels a rudiment of seede, not so much by the inbred power or faculty of the vessels themselues, as by an irradiation or beaming influence they haue from the Testicles. Finally, in the *Epididymis* and the Testicles the seed is boyled by their proper and ingenit vertue whose substance is rare, spongy and friable; and from these it is deriued into the eiaculatory vessels as an ouer plus and peculiar excrement of the Testicles. From whence it is manifest, that fruitfull & prolificall seede yssueth onely out of the Testicles not from the whole body, as we shal further prooue in our next exercise.

How this mixture becommeth seede.

QVEST. IIII. *Whether seede fall from all the parts of the body.*

ME thinkes now I see a faire and large fielde before me, wherein I may expatiate and disport my selfe a little, not restraining my discourse within those narrow cancels wherein I haue formerly confined it. It was a common receyued opinion in old time, that the seede did flow from all parts of the body. This *Hippocrates* auoucheth in his Booke *de genitura, de morbo sacro* or of the Epilepsie, & *de aere aquis & locis*, for ther he saith *That seed yssueth from al moysture which is contained in the body.* And in another place, *Seede falleth from all the parts, sound seed from sound parts; and sicke or diseased from diseased parts.* Hence it is, that lame men beget lame children, bald men bald children, and Spleniticke men children afflicted with the Spleene. This opinion is confirmed by foure reasons. First, because in the acte of Generation or Copulation the whole bodie is delighted and as it were stupified with an extasie of pleasure, or if you wil, suffereth a pleasant Convulsion. Whence it was that coition is called *parua Epilepsia*, a light Fit of the Falling sickenesse, as we saide euen now.

The olde and receiued opinion.

Hippocrates.

Confirmd by foure reasons

The second reason is, because the Childe beareth the Carracter of the Fathers imperfections: Balde men, balde children; Lame men, lame children and so likewise in all the Cense of Hereditary diseases.

Thirdly, because those that are immoderate in the vse of *Venus* doe waste and consume all the parts of their bodies. Finally, because children do resemble their parents in all parts of their bodies.

There is an elegant History of a Boy in *Calcedo*, who bare in his right arme from his birth certaine markes which were feared before in his Fathers right arme also.

An elegant history.

But this opinion is gainsayed and disprooued by *Aristotle* in the 17. and 18. chapters of his first Booke *de generatione Animalium*, & that with weighty arguments which we list not heere transcribe. *Fernelius* also in the seaueuth Booke of his *Physiologia* and the second Chapter addeth other reasons to which we referre the studious Reader. It shall suffice vs in this place to answere the former arguments.

Aristotle. Fernelius.

The argument drawne from the vniuersall pleasure and tickling delight of the whole body is of no force; for euen in itching the whole bodie is tickled, though onely one part itcheth. Moreouer, if the pleasure were therefore conceiued because the seed floweth from the whol body, it should not be perceiued in all the body at once but by degrees, first in one part then in another as the seede fell from this or that part. For we cannot imagine that in one moment of time the seed is deriued from al the parts into the Testicles, and so into the eiaculatory vessels. We therefore acknowledge another cause of that pleasure whereby the whole body is delighted in Coition, to wit; the high heate, froathinesse and abundant spirites of the Seede; for that Seede so qualified as it tickleth the partes of Generation which are of exquisite sense with his suddaine motion, it draweth the whole bodye into a sympathy and consent with them. For as if a Membrane be affected any way with paine, all the Membranes of the body conceyue a sense of dolour therewith: so when a Membrane is tickled the whole body receyueth a sense of delight and is likewise mooued therewith.

The former arguments answered.

Why all the body is tickled in coition.

That lame men beget lame childeren, or maymed maymed is not perpetually true, for we see oftentimes that lame men beget perfect childeren, and hee that wanteth a ioynt begetteth a childe with all his ioynts.

That in immoderate coition the whole body is resolued and consumed; happeneth because the remaynders of the Aliment and the Spirits are in such men exhausted, whereof when the partes are defrauded then they must of necessity waste and consume. And therefore *Auicen* sayeth, that the great expence of Seede wasteth the bodye fortie times so much as the expence or the losse of bloud, if the losse of them both bee proportionable.

Finally, that which they obtrude concerning the likenesse of Childeren to their Parents belongeth to a higher contemplation, and shall bee disputed at large by and by in a more conuenient place; yet thus much in the meane time wee say for answere, that the similitude they speake off proceedeth not so much from the crasse and thicke matter of the Seede, as from the formatiue faculty seated in the particular partes, and communicated to the Testicles, and at length to the Seede by the influent Spirites which are neare of kinne vnto those which haue their perpetuall residence in the parts of the body.

Wee therefore doe protest against that old errour as a beggerly rudiment receiued from hand to hand among the Auntients, that the Seede falleth from all the partes of the body.

Another opinion of those that deriue the seed from the brayne.

Some there are who deriue the greatest part of the Seed from the Brayn and the Spinall marrow. This opinion of theirs I will illustrate by authorities, examples and reasons. The authoritie is that of *Hippocrates* in his Book *de Genitura*, where he sayeth, that the Seede is diffused out of the Brayne into the Loynes and the marrow of the backe, from thence into the Kidneyes, from the Kidneyes it attayneth through the middest of the Testicles to the priuy partes. In his Booke *de Natura ossium*, hee wryteth that the Iugular veynes proceede from both sides of the heade into the Testicles, and thither conuay the Seede, wherefore from the Brayne to the Testicles *Hippocrates* sheweth a double way, the spinall marrow, and the veines behinde the eares.

Authorities to proue it.

Plato in his *Timæus* defineth Seede to be *A defluxion of the spinall marrow. Alcmæon. A small portion of the Brayne*; whence it is that the common people think that the braines and marrow of the bones do engender much seed.

Histories.

For the confirmation of this opinion, there are elegant Histories in *Hippocrates* Book *de aëre aquis et locis*. The first is of such men as were called μακροκέφαλοι, the other of the Scithians.

Macrocephali what they are

There were in tymes past among the inhabitants of *Europe* certayne men called *macrocephali* who were had in great esteeme, whose heades were long, and such were accounted noble and generous spirites. And therefore the Nurses were wont to presse the tender heads of Infants and to lengthen them with swathes, till at length those that by custom and constraint had long heads, begat children with long heads naturally and by conformation without any constraint at all.

The Scythians cut the veines behind the eares.

The Scithians hauing no skill at all in Horse-manshippe, and riding without stirrups, grew all of them almost to be troubled with the hipgowt or sciatica, which disease that they might cure, they caused the veines behind their eares to be opened, which being cut a sunder they after proued barren, and some thought this came to passe because the cicatrice or scarre closed vp the way of the seede descending from the Brayne. To which conceit a Lawyer it may be alluding, wrote that Theeues should haue their eares cutte off least they should beget young Theeues. They conclude therfore that the greatest part of the fruitfull and best concocted seede falleth from the Brayn and the spinall marrow. This also may be confirmed by some sleight reasons.

Reasons to confirme this opinion. *Hippocrates.*

In coition the Brayne is most chiefly affected; then the spinall marrow and the veines; and oftetimes as *Hippocrates* obserueth in his Books *Epidemion*, and *Lib. de internis affectibus*, vppon the immoderate vse of Venus there followeth *Tabes dorsalis* a consumption of the marrow of the backe.

A story out of *Albertus mag.*

Albertus Magnus maketh mention of a petulant & lasciuious Stage-player, whose head when he was dead was opened, and there was found but a little part of his Brayne left, the rest forsooth was consumed vpon harlots. Adde hereto, that vpon immoderate vse of women followeth baldnesse; now baldnes we know commeth from the want of a hot and fatty moysture, which kinde of moysture is spent in coition. And *Aristotle* saith that no man

growes

growes bald before he haue knowne the vse of Venus. This was often cast in *Cæsars* teeth when he triumphed ouer the *Galles*. *Citizens keepe vp your wiues, for wee bring home a bald Leacher*. And these are the authorities, histories and reasons whereby some are perswaded to thinke that the seed floweth from the head vnto the testicles: concerning this matter we will be bold to speake freely. *Cæsars* disgrace

I confesse that *Hippocrates* had a most happy and diuine wit, which as sayeth *Macrobius*, *would neuer deceiue any man, nor could it selfe be deceiued*. Yet herein hee hath neede to be excused, and no maruell; for in his age the Art of dissection was but rude, scarcely knowne to any man, and therefore it is that many of his sayings concerning Anatomy wee cannot either vnderstand or giue consent vnto. Sure we are that there are no manifest or conspicuous passages as yet found from the Brayn and Spinall marrow to the Testicles, vnlesse haply some small nerues which carry onely spirites but are not capable of seede: neyther yet doe we finde any braunches deriued to the Testicles from the externall iugular veines, vnlesse as all the veines of the body are continued one with another: wee therefore cannot conceiue how thick and well laboured seed should passe into the Testicles from those veins which run behind the eares. *Hippocrates* commendations. His age rude in Anatomicall dissections.

The Story of the Scythians which they obiect, who grewe barren vppon the cutting of the veines behinde their eares is of no force; for they vnderstand not aright the cause of that barrennesse. Some think that the Cicatrice or scar which grewe vppon the wound did shutte vppe the wayes of the seede. *Auicen* thinketh that it came to passe because the descent of the Animall spirit was intercepted; others think that the arteries were cut, and so the passage of the vitall spirit hindered: but these are fond assertions and sauour little of any knowledge in Anatomy; for these veines and arteries which appeare behinde the eares are externall vessels. There are farre larger vesselles internal, which runne into the Brayne through the holes of the skull, by which as by riuerets the brayne is watered and by which rather then by these outward which touch not the brayn at all, the seede should fall from the head. But let vs grant that the seede falleth through these outward veines; shall we thinke that a scarre will hinder the passage, or interclude the wayes of the seede and the spirites? by no meanes. For if thicke bloud floweth and returneth through these vesselles notwithstanding those hinderances, why should not the seed passe also which is full fraught with spirits and will passe through insensible pores. VVee must therefore enquire further for the cause of this sterility or barrennesse and not impute it to the interception of the wayes. I finde in *Hippocrates* three causes of this their sterility; their much riding, their sciatica payne, and the too great effusion of bloud vpon the cutting of those veines. Continuall riding weakneth the strength of the loynes, the kidneis and the spermatick parts: now the Scithians did vse to ride perpetually and without stirrups. How the Scythiās become barren. 3. Causes of their barrennes out of *Hippocrates*.

That much riding may bee a cause of barrennesse, *Hippocrates* sheweth in the place before quoted, where hee sayeth. *Amongest the Scythians the richest and most noble weere most of all others thus affected, the poorer sorte least of all; for the noble spirites because they vsed to ride much incurred these mischiefes, whereas the poorer sorte went on foot*. From their frequent riding proceeded also their hip-gouts, which is the second cause of sterility. For nothing so much infirmeth and weakneth the body, and to weaknes addeth the corruption of the humors, as payne. Much riding may cause barrennes. So may paine

This payne that they might mittigate they cut the veines behinde their eares, out of which issued great aboundance of bloud. And hence came the third cause of their sterilitie, for by the losse of much blood which is the very treasure of Nature, theyr Braynes weere ouer cooled.

Nowe the Brayne is a principall part, into consent wherewith the Heart and the Liuer were eftsoones drawne: and hence came it to passe that their Seede was watterish, barren and vnfruitfull. For the principall partes are all of them knitte and tyed together in so great and in so straught bandes of conspiration, that but one of them fayling, or faltering both the other are sodainly deaded or be-numbed & all their vigor and strength quite abated. And large effusion of bloud.

That their Braynes were refrigerated by the immoderate effusion of bloud, *Hippocrates* playnely declareth in these wordes. *When the disease beginnes to take hould of them they cut both the veines which are behinde their eares. And presently after abundance of bloode yssuing foorth they fall asleepe for meere weakenesse*; by which it appeareth that the cause *Hippocrates*.

of their barrenneſſe was not the cloſing vp of the paſſages, but their inordinate riding, the paine of the Sciatica and the refrigeration of the braine by the immoderate effuſion or expence of blood and ſo conſequently of ſpirits.

The obiectiō of the *Macrocephali* anſwered.

That which they obiect concerning the *Macrocephali*, doth indeede proue that the formatiue Faculty yſſueth from the braine vnto the Teſticles, but it dooth not prooue that white and perfect ſeede deſcendeth thither from thence.

why the brain is moſt affected in coition

And whereas in coition the braine and the ſpinall marrow are eſpecially affected, that commeth to paſſe, ſay we, becauſe their ſoft ſubſtance is ſooneſt exhauſted, and doth leſſe reſiſt the traction of the Teſticles. Add heereto, that the braine is the laſt part wherein the traction of the Teſticles doth reſt and determine.

Empedocles opinion.

Galen in the third Chapter of his ſecond Booke *de Semine* writeth, that *Empedocles* doth not thinke that the ſeed fell from the whol body, but half of it from one parent, halfe from the other: the more excellent parts from the Father, and the more ignoble from the Mother. But it were time ill ſpent to inſiſt vpon the anſwering of ſuch idle conceits.

The opinion of others

Some haue been of opinion, that white ſeede falleth from all the ſolid parts, paſſing from them into the ſmaller veines, out of the ſmaller into the greater, and in them rideth in the humors as a cloud or ſedement in the vrine, and ſo is drawn away by the ingenite traction of the Teſticles.

Confuted by *Ariſtotles*

Theſe men *Ariſtotle* elegantly confuteth in the places before cited, & *Galen* in his Bookes *de Semine*.

Auicens opinion.

Auicen the Prince of the Arabians contendeth, that the matter of the ſeede falleth vnto the Teſticles from the three principall parts of the body, the Braine, the Heart and the Liuer, and him haue many of the new writers followed. Neither were the Poets ignorant of this kind of Philoſophy, but leaſt it ſhould grow common or be profaned by the rude vulgar wits, they cloaked it vnder obſcure and blacke veiles and ſhaddowes of fables, as they would do a holy thing. For they thought it a great wickedneſſe and not to bee expiated, if the ſecrets of Philoſophy were bewrayed to the common people. Wherefore they feigne that when *Venus* and *Mars* were in bed together, they were deprehended or taken in the manner, as we ſay, by *Mercury*, *Neptune* and *Apollo*. *Apollo* with his rayes as with a quickning Nectar illuſtrateth them. Now by *Apollo* they meane the heart, whoſe affinitie with the ſunne is ſo great, that they call the Sunne the heart of the world, and the heart the ſunne of the body. *Neptune* the God of the Sea and the ruler of al moiſture reſembles the Liuer which is the fountain of beneficall moiſture. Vnder the name of Mercury that witty and wily God they deſigned the braine. Theſe three principles therefore reſpect *Mars* coupling with *Venus*, that is, haue the ruling power in procreation.

The Poets Philoſophy concerning this matter.

An Elegant Mythologie.

Thus haue you heard the diuerſe and different opinions of the ancients and late writers concerning this matter, it remaineth now that wee reſolue vppon ſomething our ſelues, which we will do on this manner.

What wee reſolue of.

The ſeed is a moyſt, ſpumous and white body, compounded of a permixtion of blood and ſpirits, laboured and boyled by the Teſticles, and falling onely from them in the time of generation, or from the adiacent parts. Neither do we aſcribe that faculty which they cal σπερματοποιητικὴν, *the Faculty of making ſeede* to any other part ſaue onely to the teſticles and their veſſels. But whereas there is a double matter of the ſeede, blood and ſpirits; we think that the blood is red and not at all altred by the ſolid parts, and falleth only from the veins. As for the ſpirits which are aery, thin and ſwift Natures, wandering through the whole body being neere of kin vnto the ingenite ſpirits of the particular parts, we thinke they fall into the Teſticles out of the whole body, and bring with them the Idea or forme of the parts and their formatiue faculty. And in this ſenſe haply it may be ſaide, that the ſeede falleth from all the parts of the body, but in no other.

Obiection. Anſwere.

But ſome man may ſay, If the ſeede yſſue onely from the Teſticles, how may it bee that two ſo ſmall bodies as the Teſticles are, ſhould be able to boile ſo great a quanty of ſeede? I anſwere, that heerein appeareth the wonderfull wiſedome and prouidence of the GOD of Nature, who hath made all officiall parts, not onely to draw fit and conuenient Aliment for their owne vſe, but ſo much and ſo great a quantity as may ſuffice the other intentions of Nature alſo. So the Liuer draweth more blood out of the Veins of the Menſetery then is ſufficient for his owne nouriſhment, ſo the heart generateth abondance of ſpirits; not onely for his owne vſe, but to ſuſtaine the life of all the parts. The Teſticles therefore beeing common and officiall members, and the firſt and immediate organs of generation, do draw more blood then may ſuffice for their own ſuſtentation, which ouerplus being there

The wonderfull prouidēce of God.

arri-

arriued, is by them continually concocted and boyled into seede.

QVEST.V. *Whether women do yeelde seede.*

CAAA Oncerning the seede of women, there is a hot contention betweene the *Peripatetians* and the Physitians. *Galen* in his Bookes *de Semine*, and in the 14. book *de vsu partium*, elegantly discusseth the whole question, wherefore that which he there hath at large and in many words exemplified, wee in this place will contract and draw into a briefe summe. There shall be therefore three heads of this Disputation. First of all we will propound the reasons of the *Peripatetiks*. Secondly, we will giue you a view of the opinion of the Physitians; and lastly wee will answere all Obiections that are brought against the truth.

Three heades of this Controuersie.

Aristotle in his Bookes *de Generatione Animalium* contendeth, that women neither loose any seede in the acte of generation, neither yet indeede haue any seede at all, and that for these reasons.

The argumets of the *Peripatetiks* that women haue no seede.

First, because it is absurd to thinke that in women there should be a double secretion at once of blood and seede. Secondly, because women in their voice, in their haire & in the habit of their body, are most like vnto Boyes, but boyes breede no seed. Thirdlie, because women do sometimes conceiue without pleasure yea against their wils. For *Auerrhoes* telleth a Story of a woman who being in a Bath together with some men, receyued seed that fell from them and floted in the water and thereupon conceiued. Fourthly, because a woman is an vnperfect male, and hath no actiue power but onely a passiue in generation. Finally, because if women should loose seed they might engender without the helpe of the male, because they haue in themselues the other principle of generation, to wit, the Menstruall blood.

On the contrary, the Physitians bring stronger arguments to prooue that women yeeld seede. This first of all men *Hippocrates* auoucheth in his Bookes *de Genitura* and *de diæta*, where he doth not onely acknowledge that women haue seede, but adderh moreouer, that in either sexe there is a twofold kinde of seede, one stronger, another weaker. *Aristotle* also himselfe in his tenth booke *de Historia Animalium* is constrained to confesse that to generation there is necessarily required a concourse of the seeds of both sexes.

The opinion of the Physitians. *Hippocrates.* *Aristotle.*

Galen in this businesse hath so excellently acquitted himselfe, that he hath preuented all men after him for gaining any credit by the maintenance of this truth. Notwithstanding, we will endeauour by demonstratiue arguments to make it so manifest, as for euer all mens mouths shall be stopped.

Galen.

First therefore it is agreed vppon by all men, as well Physitians as Philosophers, that Nature endeuoureth nothing rashly or in vaine. If therefore there bee all Organes for generating, boyling, and deriuing or leading seede to the parts of generation in Women as in men, it must needs follow that they also doe generate, boyle and leade downe seede. Now for the preparation of seede they haue foure vessels, two veines and two Arteries, for the boyling and perfecting seede they haue testicles, for the leading it down they haue eiaculatory vessels. And this is agreed vpon by all Anatomists.

The reasons on the Physitians side.

I know well that the *Peripatetiks* will Obiect, that in those vesselles there is conteyned a kinde of wateriſh moysture and serous but nothing sufficiently boyled, and that the Testicles of women haue as much vse as the paps in men. But how miserably they are deceiued, good reader be thou iudge. If those preparing vessels do containe nothing but a whaey and serous moisture, crude and vndigested, why are they contorted with so many Girations and Convolutions? why so wreathed and plighted one with another? Nature no where in all the body hath made any web or complication of vessels but onely for a newe coction and elaboration. Add heereto, that if these vessels do onely yeelde a wateriſh and serous humor, why doth the spermaticall veine insinuate it selfe into the spermaticall artery, so that of two vessels they become but one, as it is in men? Is it not rather therefore, that the double matter of the seede should be exquisitely mingled, and one body made of the permixtion of blood and spirits? As for the proportion betweene womens Testicles & mens breasts, we say it is not equall. For the Pappes in men serue onely for ornament, to strengthen the chest and defend the noble parts therein contained. The Testicles of women vnlesse they make seede, are altogether vnprofitable. The Pappes of men haue no Glandules, neyther do they generate milke; the Testicles of women are perfect Glandules, and

Obiection. Answere.

That there is not the same reason or proportion in the paps of men, and the Testicles of wome.

An argument from the eiaculatory vessels.

and their substance is mouable and hollow or cauernous as they are in men. Moreouer, why are the eiaculatory vessels which are inserted into the sides of the wombe, which they commonly call the hornes, more intorted in women then in men, but only that the shortnes of the way might be recompenced by the variety of the complications? What neede was there of so great curiosity in this admirable work of Nature, if it had been only for the Generation or eiaculation of a crude and waterish humour.

Another demonstration.

This demonstration we take to be strong enough and indeed not to be gayn-sayed; yet giue mee leaue to strengthen it yet more with another. There is nothing more certayne then that woemen in their accompanying with men doe loose somewhat from whence comes their pleasure and delight. That therefore which is auoyded is either bloud; or a thinne and serous humour, or perfect and laboured seed. No man in his right wits will say it is bloud; for when the courses flow there is no pleasure, no delight followes thereuppon; yea most commonly dire and terrible racking paynes. That it is not a serous or vnconcocted humour is conuinced by the wonderfull structure of the preparing and by the complications of the eiaculatorie vessels. VVherefore it remayneth that it must bee something well concocted and laboured in these complications which they loose. And that is Seed, which is prooued by the white colour, the thickenesse and the spirites wherewith it is houed and turgid.

If you dissect the organs of women which haue long refrayned the vse of men, you shall finde their vesselles and Testicles full of seede. Adde hereto that those who of a long time haue intermitted the vse of the mariage bed, or otherwise are wanton women doe in their sleepes auoyde great quantity of seede. And are not women often troubled with the *gonorrhœa* or running of the reynes and that disease which we cal *priapismus*? Yea sometimes when their genitalles are full of seede they grow into woodnesse and rage of lust, and euen to bee starke mad indeede; but after that seede is auoyded they come againe vnto themselues.

Another opinion of some *Peripateticks*.

Continuall experience tels that those Females which are castrated or gelt, will neuer admitte the vse of the Male, but the goads of lust are in them vtterly extinguished. The strength and validitie of these arguments haue driuen many of the *Peripateticks* to confesse that women also doe auoyde seede, but least they should depart from the opinion of their Maister *Aristotle*, they say that that seede is vnfruitefull, hauing in it no actiue or operatiue faculty or power. So that all the actiue power of generation they attribute to men, comparing the man to the Artificer and the woman to the wood which hee squareth and heweth and worketh into a shape or forme. The man they say yeeldeth the Soule and the forme, the woman onely the matter.

Auerrhoes. *Albertus Magnus.*

The principall of this sect are *Auerrhoes* and *Albertus Magnus*: for say they, whereas in euery Nature there must be a Patient correspondent and answerable to the agent, it is most likely that the passiue power is giuen to women which might answere to the actiue power in men. And truely to receiue the seede, to conceiue it, to beare the burthen and to nourish the Infant; are all arguments of a passiue faculty.

Womens seed is operatiue.

With this deuice they think they haue eluded and escaped the darts of the Physitians, when yet alas they wallow still in the same myre. For, to auoyde white, spumous, thicke and well concocted seede is all one as to auoyde actiue and operatiue seede. For will the spirites which are brought by the spermaticall arteries and are exquisitely mixed with the bloude in these mazy complications, play them idlie in the conformation? Or shoulde we not rather beleeue that the spermaticall partes are of them generated as of their proper matter? The seed therefore of vvomen is actiue as that of men, but yet it is vveaker, because it is lesse hot and hath in it fevver spirits.

A strong reason of *Galens*.

I vvill giue you a taste of one or tvvo of *Galens* arguments vvhich shall manifest the fœcundity and fruitfulnes of vvomens seede.

How children become like their parents.

That the childe is sometimes like the father sometimes like the mother no man vvill deny. This similitude is either from the seede or from the menstruall bloud; not onely from the menstruall bloud, because then children should alvvaies be like their mothers neuer like their fathers; neither onely from the seede of the father, for then children should alvvayes bee like the father and neuer like the mother: the similitude therefore proceedeth from a common cause issuing from them both, vvhich common cause is seede. The *Peripateticks* vvill answvere that sometimes the children are neither like father nor mother, but like their grandfathers or great grandfathers, vvho neither actiuely nor passiuely did contribute any thing

thing to their generation. But I cannot see what they can answere to that argument of hereditary diseases.

The woman that is troubled with the Gowt bringeth foorth a son subiect to the gowt, if she be subiect to the Falling sickneſſe she will bring foorth an Epilepticall infant, or being troubled with the Stone a childe disposed to that disease; these diseases I hope they wil not say come by reason of the fault of the blood. For who euer was so mad to say, that the Menstruall blood contained in it the Idea or forme of the particular parts? The impurity of the blood wil indeede make the childe weake and sickly; but to make a calculous impression in the Kidneyes, or a gowty impresion in the ioyntes is onely proper to the seede, which conteyneth in it the fatall necessity of life and death.

Againe, all formation and specification (for you must giue vs leaue to vse our Schoole-tearmes in these matters of Art) that is, all power to set the seale or figure or difference vpon any thing, proceedeth from the seede alone. For the matter as it is a bare matter cannot chaunge the species or forme of any thing, but the species followeth rather the Dam then the Sire. For if an Ewe be couered by a Goate, she will not bring foorth a Kid but a Lamb with a hard and rugged wooll; if a Tup couple with a she-Goat, she will bring forth not a Lambe but a Kid with a soft wooll, as *Athenæus* auoucheth. There proceedeth therefore from the Dam a formatiue Faculty, now all formatiue faculties as we said is from seed, none at all from the blood. A third. Note this. *Athenæus.*

But there is a place in *Galen* which seemeth to be against vs. For in the first chap. of his 14. Booke *de vsu partium* he denieth to the seede of the woman the power of procreation. A woman (saith he) because she is colder then a man, hath in her *Parastatæ* a thin and vnconcocted humor, which conferreth nothing to the procreation of the infant, and therefore when it hath done his office it is cast foorth; but another humour, that is the seed of the man, is drawne into the wombe. Wee must thus vnderstand *Galen*, that in women, beside their seede, there is another wateriſh moysture which delighteth, tickleth and washeth their genitals; and that indeede conferreth nothing to generation, for so he saith a little after. But in the time of coition that humor suddenly and together with the seede yssueth, and therefore mooueth the sense; at other times it yssueth also by little and litle and sometimes without any sense at all. We conclude therefore, that women do yeeld seede which hath in it some operatiue or actiue faculty. A hard place in *Galen*. Expounded.

The vse of this seede according to *Galen* in the eleuenth chapter of his fourteenth booke *de vsu partium* is manifold. First for generation, for by it as by a workman concurring together with the seed of a man, the parts are figurated; and of it as of their matter the membranes are generated wherewith the infant is compassed. The second vse is to be an Aliment for the hotter seede of the man. For euery hot thing is noriſhed by that which is moderately cold, that is, lesse hot as saith *Hippocrates* in his Booke *De Alimento*. The thirde vse is to irrigate or moysten the sides of the wombe, for all the parts of the womb could not be lined or moistened by the seede of the man. The last vse *Galen* addeth, which is to open the necke of the matrix. The vses of a womans seed. *Hippocrates.*

Argenterius derideth these vses of the seede, because nothing is nouriſhed that doth not liue, but the seede liueth not. Againe, the seede of the woman is not eiaculated into the sides of the wombe, because a womans wombe hath no hornes. But he is indeed himselfe ridiculous, endeuouring to correct *Magnificat* as we say, when hee cannot sing *Te Deum*. Neither shall you finde any man more forward to carpe at others, then those who themselues lye most open to scorne and disgrace, as that petulant Author doth in most passages of his workes. But for your sakes who may haply learne something by it, we will do him the honesty to answer his cauils. *Argenterius* the Cauiller. Answered.

We say therefore, that the seed is potentially Animated, & when it is cast into the womb that power by the heate of the womb is broght into an act, and therefore presently it worketh the workes of the soule; for it formeth and figurateth the parts. If then it be animated it liueth, but that life is the life of a plant. Beside, when *Galen* saith that the seed of a man is nouriſhed by the seede of a woman, we must not be so grosse as to vnderstand him as if he meant a perfect nouriſhment which is made by assimulation; but because the seede of the man was hotter then the seede of the woman, it is tempered and made more dilute or fluxible by the cold and thin seede of the woman. After the same manner we say, that the spirits are nouriſhed by the aer, and so we must vnderstand *Hippocrates* where he saith, *That euery hot thing is nouriſhed by that which is moderately cold.* *Galen* expounded. By *Hippocrates.*

That

That the ſeede is not eiaculated into the ſides of the wombe becauſe the womb hath no hornes, ſauoureth of Craſſe and palpable ignorance of the inſertion of the eiaculatory veſſels into the ſides of the bottome of the wombe, and ſo we let it paſſe.

Anſwer to the *Peripatetiks* arguments.

It remaineth now that we make aunſwere to the arguments of the *Peripatetickes*. Firſt therefore

1 That double ſecretion or profuſion of blood and ſeede we do not thinke is made togither and at once but at diuers times; that is, of ſeed in the coition and conception, of blood immediately after the firſt diſcretion or ſeparation of the ſpermaticall parts.

2 There is not the ſame reaſon of young boyes and of women. For in Boyes there is no remainder of lawdable blood of which ſeede ſhould bee made, becauſe one part of the blood is conſumed in their nouriſhment and the reſt in their growth, but in women there is abundance of ſuperfluous blood.

3 Thoſe women who do conceiue without pleaſure haue ill affected wombes.

4 *Auerrhoes* his Hiſtory we take to be a right old wiues tale and no credit to be giuen thereto.

5 That a woman is not an imperfect male, but a perfection of mankinde wee haue abundantly prooued before.

6 The laſt argument of *Ariſtotle* which carrieth moſt ſhew of truth, we may thus anſwere. Although a woman haue in her ſelfe the efficient and materiall cauſes of generation; yet cannot ſhe generate in her ſelfe without the helpe of the man; I ſpeake of a lawfull generation, becauſe her ſeede is but weake and too cold. We ſee that Henns wil lay Egges without the Cocke, which we cal Addle egges becauſe they will neuer proue Chickins, yea neither Cockes egges which ſometimes they lay will proue any thing. Wherfore the concourſe or confluence of the ſeedes of both ſexes is of abſolute neceſsity in generation.

Valeſius his opinion.

Valeſius anſwereth this Obiection thus; that if a woman be of a cold conſtitution her ſeede is too weake to endeauour of it ſelfe the conformation of the parts. If the woman be hotter, then is her ſeede fruitfull enough and of ſufficient power, but then there is in ſuch women want of the remainder of Aliment by which the ſeede conceiued and formed in the wombe might be nouriſhed. Wherefore a hot woman without a man may generate but cannot nouriſh and perfect that which ſhe hath conceiued. But if theſe things were ſo as *Valeſius* woulde haue them, then hot and manniſh maydens without the embracements of men ſhould ſuffer many abortments. And ſometimes it hath bin obſerued that the geniture yſſuing from a woman the ſeuenth day after conception hath bin dearticulated, ſo that in it hath appeared the rudiments of the three principall parts and the threds of al the ſpermaticall parts very conſpicuous: For theſe are the workes of ſeede onely and not of blood, becauſe the blood conferreth nothing to the conformation and diſcretion of the parts, neither yet floweth vnto the Conception till the deſcription of the ſpermaticall parts bee begun. And thus much of the ſeede of women wherein I haue beene ſomewhat more large, becauſe the Aduerſaries are in this point very violent and will hardly be gainſaide, whatſoeuer euidence of reaſon is brought againſt them. Now we proceed to the manner of the emiſsion of ſeed.

Diſprooued.

QVEST. VI. *Of the Excretion of the Seede, by what power or Faculty it is accompliſhed.*

Whether the excretion of ſeede be Naturall or Animall.

Concerning the excretion or auoyding of ſeede, there remaines two things to be handled, two doubts to be cleared. Firſt, by what power or Faculty this excretion is made, by the Naturall or by the Animall. Secondly, why there is ſo great pleaſure in the emiſsion of ſeede. Both theſe doubts it ſhall not be hard to aſſoil, yet becauſe we would giue the Reader full ſatisfaction, we wil inſiſt ſomwhat the more particulary vpon them.

That it is naturall. Reaſon 1.

That the excretion of ſeede is altogether Naturall may thus bee demonſtrated. Becauſe euery excrement is driuen foorth by the power of Nature, and ſeede is an excrement. So the menſtrual blood which is a profitable excrement of the laſt Aliment of the fleſhy parts is purged onely by the force of Nature at certaine times and determinate courſes; wherevpon we cal them *Courſes*. So the Chylus which is the excrement of the ſtomack, although it be profitable is thruſt downe into the guts by the ingenite faculty of the ſame ſtomacke onely. So the excretion of the excrements of the belly and of the bladder is meerely Naturall. Moreouer for the excretion of ſeed, Nature hath ordained no Muſcles at all, for there

appeare

appeare none in the ſpermaticall veſſelles nor in the Teſticles nor in the *Proſtate* Glandules.

Happely you will ſay there are the muſcles called *Cremeſteres* which compreſſe the Leading veſſels, by which compreſsion the ſeede is ſtrayned forth; but we do not acknowledge that vſe of the *Cremaſter* muſcles, becauſe in the veſſelles of ſeed which are in women there are no ſuch muſcles found, who notwithſtanding auoyde ſeede as well as men as hath bin proued. Hereto may be added the authority of *Hippocrates*, at leaſt of *Polybius* in his book *de genitura*, who referreth the cauſe of excretion to the ſpumy or frothy nature of the ſeed, which thence being turgid and not able to containe it ſelfe in his place, maketh way for his owne euacuation. Obiection. Anſwere. Hippocrates authority.

On the contrary that the excretion of ſeede is Animal theſe arguments may perſwade: Firſt, becauſe neither whileſt we wake, nor in our ſleepe there is any ſuch excretion vnleſſe the force of the imagination goe before it. Secondly becauſe in the auoyding of ſeed the legges and the armes are contracted and the whole body ſuffereth a kinde of convulſion; whereupon as wee haue already ſayed, *Democritus* calleth coition a light *Epilepſie* or falling ſicknes. Thirdly, becauſe that excretion is made ſometime flower ſometimes ſooner according to our arbitrary will and diſcretion. Finally, becauſe it is alwayes ioyned with pleaſure, now pleaſure is an affect of the ſenſatiue faculty which is meerly Animall. That it is animall. Reaſon. 1.

We are of the ſame opinion concerning the eiaculation of Seede that wee were of concerning the erection of the yarde, to witte, that it is a mixt action of a Naturall and an Animall. It is Animall becauſe it hath imagination going before and pleaſure alwayes accompanying it. It is Naturall, becauſe it is made when Nature is prouoked either by an itching or tickling quality, or oppreſſed with a burden of aboundance and that without the help of muſcles. What we conclude of. It is a mixt action.

But it muſt be remembred that we here ſpeake of that profuſion of ſeede which is Naturall, not of that which is ſymptomaticall, which they call the *Gonorrhæa* or running of the reynes; which neither hath any imagination going before nor pleaſure accompanying it, neither yet is driuen out by the ſtrength of Nature, but falleth away by reaſon of the acrimony of the ſeede, the weaknes of the veſſelles, their convulſion and the inflamation of the neighbour parts: finally, which bringeth vpon the Patient an extenuation and conſumption of the whole body. Witnes that Satyre in *Thaſo* whoſe name was *Grypalopex*, of whom *Hippocrates* maketh mention in the 7. Section of the 6. Booke *Epidemion*, who at the age of 25. yeares poured out his ſeed in great aboundance night and day, and in the 30. yeare was vtterly conſumed and ſo dyed. The cauſes of the running of the reynes. A ſtory of a Satyre.

QVEST. VII. *Whence commeth the pleaſure in the eiaculation of Seede.*

THE wonderfull prouidence of Nature hath giuen to all Creatures certayne goades and prouocations of luſt, and an impotent deſire of copulation for the preſeruation of the ſeuerall kindes of Creatures, becauſe the *Indiuiduum* or particular is of it ſelfe and by an inbred neceſsity diſſoluble and mortall. And indeede this ſting of pleaſure was very neceſſary, without which man eſpecially the one ſexe in ſcorne and deteſtation of ſo bruitiſh and baſe a worke, the other for feare of payne and trouble, would haue abhorred this woorke of Nature. The Finall cauſe therefore of this pleaſure which is conceiued in the whole action of copulation, but eſpecially in the emiſsion of the Seed, is onely the conſeruation or preſeruation of mankinde. The finall cauſe of pleaſure in coitiõ.

The Efficient cauſes of this pleaſure we acknowledge to bee many and diuerſe; to omit the reſt, we will make mention onely of three which are the eſpeciall and moſt immediate. The firſt is the tickling of the turgid and itching ſeed: now the ſeed is turgid, that is, houen or frothy by reaſon of the impetuous motion of the ſpirites; for ſeede without ſpirites ſuch as is auoyded in the *Gonorrhæa* breedeth no pleaſure at all; after the ſame manner thoſe that abuſe the vſe of woemen by frequent copulation haue leſſe pleaſure then other men becauſe they haue fewer ſpirits. 3. Efficient cauſes.

Yet is not this cauſe of it ſelfe ſufficient to procure pleaſure ſuch eſpecially as is conceiued, but another cauſe is required which is the celerity or ſwiftneſſe of the motion and of the excretion. For as paine is neuer cauſed vnleſſe there bee a ſudden and ſwift alteration, ſo vvhen the ſeed iſſueth by little and little or vveepingly, there is no pleaſure at all. Finally, to theſe tvvo is added the exquiſite ſence of the partes of generation and their narrovvnes,

rowneſſe. For ſo the parts being tickled, and the veſſelles which were diſtended returning into their naturall ſcituation and conſtitution, there is ſtirred vp a wonderfull delight and pleaſure. But that theſe things may be made more euident we will handle heere two pro-

2. Problemes The firſt. blemes. The firſt; why the ſpirits as they paſſe through the other parts, Veines, Arteries, Sinnewes, Membranes theſe laſt eſpecially being of exquiſit ſenſe, together with the blood and the humors, do not induce the ſame pleaſure which they doe in the ſpermaticall Organs. Haply it is, becauſe this kinde of ſenſation by the wonderful prouidence of Nature

Solution. is beſtowed onely vpon the genitals for the conſeruation of the ſpecies or kinde, like as ſhe hath giuen onely to the mouth of the ſtomacke the ſenſe of diuulſion and appetite. Or we may ſay, that in the other veſſelles there is not ſo ſudden and headſtrong an effuſion of humors and ſpirits together.

The ſecond Probleme. The other Probleme is, why men and woemen that are aſleepe haue great pleaſure in their Nocturnall polutions, ſeeing that in ſleepe the ſenſatiue faculties are all at reſt: for

The Solution the Philoſopher calleth ſleepe ἠρεμία τῆ πρώτῃ αἰσθητικῆ, *the reſt of the firſt ſenſator*: Wee anſwere firſt, that the imagination in ſleepe is ſtronger then when wee are awake, as appeareth in thoſe that walke and talke in their ſleep. Againe, in ſleep the ſenſes are not ſo drowned in ſenceleſneſſe but that they are rowzed vp by a violent obiect, and therefore ſuch awake if they be violently ſtirred: and for the moſt part ſuch nightly pollutions doe awaken thoſe who are troubled with them. If you prick a ſleeping man with a Needle euen before he awake he gathereth vp his body; and if you continue he will awake though hee ſleepe neuer ſo ſoundly. Now the excretion of ſeede in a dreame is indeede a very ſtrong obiect

Whether me or woemen haue greater pleaſure. to the ſpermaticall parts. Theſe therefore are the cauſes of pleaſure in the excretion or auoyding of ſeede. But whether the pleaſure of the man or of the woman be the greater,

The anſwere. it would be a vaine and fruitleſſe diſquiſition to enquire. Indeede the woman conceiueth pleaſure more waies, that is in the auoyding of her owne ſeede and alſo in the attraction of the mans: for which cauſe the *Tyreſian* Prieſt who had experience of both ſexes preferred the woman in this kinde: but the pleaſure of the man is more intenſe, partly becauſe his ſeede is more hot and ſpirituous, & partly alſo becauſe it yſſueth with greater violence and with a kinde of Almaine leape or ſubſultation.

And thus much concerning the firſt principle of generation, that is, the ſeed of both ſexes. Now we come to the ſecond principle, which is the Mothers blood.

QVEST. VIII. *Whether the Menſtruall Blood haue any noxious or hurtfull qualitie therein.*

CONcerning the Nature of the Menſtruall blood, there hath been and yet is ſo hard hold and ſo many opinions euen among Phyſitians themſelues, that it were a ſhame to make mention of all their differences, much more to inſiſt vpon them. But becauſe we would pretermit nothing that were worthy of your knowledge, wee will inſiſt vppon the chiefe heads of the Controuerſie. The firſt of which ſhall bee concerning the matter of the Courſes.

Of the matter of the courſes All men do agree that this blood is an excrement, for like a ſuperfluity it is euery month driuen foorth of the wombe; but becauſe there are two kinds of excrements, the one Naturall and profitable, the other altogether vnprofitable and vnnaturall, wee muſt enquire of which kinde this menſtruall blood is.

That it is ill qualitied. That it is an vnprofitable excrement and of a noxious or hurtfull quality, may bee proued by the authority of famous learned men, as alſo by ſtrong reaſons. *Hippocrates* in his

Hippocrates authority. firſt Booke *De morbis mulierum*, expreſſeth the malignant quality thereof in theſe words, *It fretteth the earth like Vineger, and gnaweth the body of the woman whereſoeuer it lighteth and vlcerateth the parts of generation.* *Ariſtotle* in the 19. Chapter of his fourth Booke *De Natura Animalium* writeth, that that kind of blood is diſeaſed and vitiated. *Galen* in the eight Chapter of his Booke *de Atra bile* ſaith, that euery moneth a ſuperfluous portion of blood vnprofitable not onely in quantity but alſo in quality is auoided. *Moſes* that great Law-gi-

Moyſes. uer as we read in holy Scripture, made an Edict that no Menſtruous woman ſhould come into the Sanctuary, *Let her touch no holy thing, nor enter into the Sanctuary whilſt the dayes of her purgation be fulfilled.* By the Lawes of the *Zabri*, thoſe women that had their courſes were interdicted the company and ſociety of men, and the places where ſhe did ſtand were cleanſed by fire. *Heſiodus* forbiddeth that any man ſhould frequent thoſe bathes where

Men-

menstruous women haue bathed themselues. *Pliny* also in the 28. Chapter of his 7. booke & *Columella* doe think that this bloud is not only vicious but poysonous. For by the touch thereof the young vines do wither, the buds of hearbes are burnt vp, yea glasses are infected with a kinde of *tabes*. If a Dogge licke of it he will run mad; and wanton women are wont to bewitch their Louers with this bloud; whence *Ouid* calleth it *Lunare virus*, the Moone poyson; wherefore it is not onely superfluous in quantity but in the whole quality a noysom excrement. This poysonous quality thereof women haue dayly and lamentable experience of in their owne bodies, for if it bee suppressed it is a wonder to see what horrible and how many *symptomes* doe arise there-from.

Pliny. *Columella.* Reason and experience.

If (sayeth *Hippocrates* in his first Booke *de morbis mulierum*) it bee stabled without the wombe; it ingendereth Inflamations, Cancers, Saint Anthonies fires, and *scirrhous*, that is, hard and indolent tumors. If it returne vnto the vpper partes it breedeth many diseases which follow the Nature of the part affected and the offending humour. In the Liuer it breedeth the *Cacexia*, the Iaundise, the Dropsie. In the Spleene obstructions and *Scirrhous* tumors: in the Stomacke, depraued Appetite and strange longings: in the Heart palpitations and Syncopes or sounding; in the Lungs Vlcers and Consumptions: in the Brayn the falling sicknes and mad melancholly, and many other such like.

What diseases come therefrom.

Amongst the new writers *Fernelius* the best learned Physitian of them all, in the 7. book of his Phisiologie, proueth that this bloud is not Alimentarie nor of the same Nature with that by which the Infant is nourished in the mothers wombe, but thinketh it noxious and hurtfull both in the quantity and quality.

Fernelius opinion.

On the contrary we thinke, and perswade our selues wee shall also conuince others, that this bloud which is monthly euacuated by the wombe, is all one with that bloud whereof the *Parenchymata* or flesh of our bowels are made, and wherewith the Infant in the wombe is nourished, and that it is in his owne nature laudable and pure bloud and no way offensiue to the woman but onely in the quantity thereof. And this we hope wee shall euict both by authority of the Antients and by inuicible and demonstratiue arguments.

The contrary opinion that it is naturall.

First of all *Hippocrates* fauoureth this opinion as also doth *Galen*. *Hippocrates* in his first Booke *de morbis mulierũ* hath this saying. *The bloud falleth from a woman like the blond of a stickt Sacrifice, which soone cloddeth or caketh together because it is sound and healthfull.* And this also he repeateth in his Booke *de Natura pueri*: now the conditions of laudable bloud are, to be red and quickly to cake. *Galen* in his third Booke *de causis symptomatum*, writeth that this bloud is not vnnaturall, but offendeth onely in quantity. And this may also be demonstrated by good and true reasons: this bloud in a sound woman (for if shee bee sickly the whole masse of bloud is corrupted) the bloud I say that is auoyded euery month by the wombe, is made of the same causes by and of which the other bloud is made with which the flesh is satisfied and nourished. For the matter is the same, the same heat of the Liuer, the same vessells conteyning it, why then should there bee any difference in their qualities?

Hippocrates. *Galen.* Reasons to proue it naturall.

Moreouer, if (as the Philosopher often vrgeth) the Finall cause be the most noble, and preuayleth in the workes of Nature ouer all the rest, why should this superfluous bloud redound in the colde Nature of women, vnlesse that it might become an Aliment vnto the conceiued and formed Infant? why doeth shee purge it rather by the wombe then by the nose, as it is often auoided in men? vnlesse it be to accustome her selfe to this way, that after the conception it may exhibit it selfe for the nourishment of the Infant.

First. The second.

This is the finall cause of the menstruous bloud acknowledged by *Hippocrates*, *Aristotle*, *Galen*, and all the whole schoole of Physitians. *Aristotle* sayeth that such is the Nature of a woman, that their bloud perpetually falleth to the wombe and the principall parts, & therfore if they be haile and sound of body and haue their courses in good order, they are neuer troubled with varices or swollen veines, neuer with the *Hæmerrhoids* nor with bleeding at the nose as men are.

Now if these courses doe affect the way into the wombe for no other cause but onely for the nourishment of the Infant, then no man will deny but that it is benigne and laudable bloud. For *Hippocrates* in his Booke *de Natura pueri* and in the first booke *de morbis mulierum* sayeth, that the Infant is nourished with pure and sweete bloud; in the first place he sayth, that the Infant draweth out of the bloud that which is the sweetest; in the second, that the woman with childe is pale all ouer, because her pure bloud is consumed in the nourishment and increase of the Infant.

Third. Moreouer, that the bloud which Nature purgeth by the wombe of a ſound woman is pure and Elementary, this is a manifeſt argument becauſe of it returning to the paps milke is generated, and therefore Nurſes haue not their courſes as long as they giue ſucke; nowe that milke is made of the pureſt blood, *Hippocrates* witneſſeth in his Booke *de Natura pueri.*

Why Nurſes haue not their courſes neither yet conceiue. *Ariſtotle* in the firſt Chapter of his fourth Book *de Generatione Animalium*, ſayth that the nature of the Milke and of the menſtruous bloud is one and the ſame, and thence it is that thoſe that giue ſucke haue not their courſes, neither yet do conceiue with childe, and if they do happen to conceiue, then their milk faileth.

Add hereto that if the impurity of the courſes were ſo great as ſome would haue it, then it would follow that when women are with childe and their courſes faile vppon that cauſe, they ſhould be worſe diſpoſed, then if they ſhould faile vppon other cauſes, becauſe the Infant drawing away the purer part of the bloud, that other which is venomous or of a malignant quality would rage ſo much the more hauing loſt the bridle whereby it is reſtrayned: moreouer thoſe *ſymptomes* would be more violent in the laſt moneths then in the firſt after conception; all which is contradicted by common experience.

Concluſion. Wherefore the menſtruall bloud is onely aboundant in women, and hath no other fault at all, if they be ſound and hayle; and is of the ſame Colour, Nature and Temperament with the reſt of the bloud conteyned in the trunke of the hollow veine, and wherewith the fleſh is nouriſhed. Yet is it called an excrement but that κατ' ὀχρεσιν abuſſuely; becauſe the fleſh being therewith filled and ſatisfied doth returne that which remayneth back into the veines and voyde it out; ſo the Stomacke beeing ſatisfied with the Chylus thruſteth it into the Guttes.

Auicens queſtion. But *Auicen* maketh a queſtion whether this menſtruall bloud be an excrement of the ſecond or of the third concoction; we ſay it is of both but in a diuerſe reſpect.

Anſwered. It is an excrement of the ſecond concoction, becauſe the whole maſſe of bloud hath his firſt Generation in the Liuer the ſeate of the ſecond concoction, and from the Liuer is powred as an ouerplus or redundancie into the trunk of the hollowveine. It is an excrement of the third concoction, becauſe it is as we ſayd vomited away by the fleſh when it is ſatisfied after the third concoction.

Anſwere to the former arguments. Thoſe arguments which before were alleadged againſt this truth are but veine and light. For as we grant that all thoſe miſchiefes and inconueniences before named doe happen in a diſeaſed woman, ſo we deny that there is any ſuch in a ſound, haile and well diſpoſed womans body. And if at any time the ſuppreſsion of the courſes in a ſound body doeth bring forth any of thoſe fore-mentioned *ſymptomes*, that commeth to paſſe becauſe of the ſtay & abode of it, or elſe becauſe euill humors doe fall together with the blood vnto the wombe which is a common ſinke as it were of the body, by the permixtion of which humours the blood acquireth a malignant quality.

The diſcomodities of the courſes proue their purity. Thoſe incommodities of the menſtruous blood before remembred, are great arguments of the purity thereof: for thoſe thinges which are moſt pure are ſooneſt vitiated, and being once taynted are moſt offenſiue; ſo the *ſymptomes* of ſuppreſſed ſeede are more grieuous then thoſe that come from the ſuppreſsion of the courſes, becauſe the ſeede is the purer and fuller of ſpirits.

Hence it is that the carkaſſe of a man caſteth a worſe ſtench or ſauour then the carkaſſe of any other creature, becauſe a mans body is of all other the moſt temperate. And *Hippocrates* in his Booke *de morbis* ſayth, that by how much the Aliment is better and more pure, by ſo much is their corruption worſe and more offenſiue. And thus much of the Nature and quality of the menſtruous blood.

QVEST. IX. *Whether the menſtruous bloud be the cauſe of thoſe Meazels and ſmall Pocks which are wont once in a mans life to trouble him.*

The queſtion IT belongeth not to this place to diſpute of the Nature, differences and all the cauſes of the ſmall pockes, as alſo whether the *varioli*, *morbilli*, *exanthemata*, and *ecthymata* be of one and the ſame Nature or no; wee will onely touch that which pertayneth to our preſent purpoſe.

It is a very obſcure queſtion which hath a great while exerciſed the wits of many men, *Whether the ſmall Pocks and Meazels which are wont once in a mans life to happen vnto him, doe come by reaſon of the impurity of the menſtruall bloud.* I will not heere enlarge my ſelfe to reckon vp vnto you all the opinions of all men which haue written

written of this queſtion, but onely tell you what we thinke and that as ſhortly and perſpicuouſly as the Nature of the cauſe will giue leaue. It is a ſure thing, that among ten thouſand men and women there can bee ſcarce one found who once in their life are not afflicted with this diſeaſe. *Auenzoar* writeth that it is almoſt a miracle if any man eſcape them. It is therefore a common diſeaſe becauſe it taketh hold of all men. All men haue once the ſmall pox.

Now it is *Hippocrates* reſolution in his Booke *de Natura hominis*, that common diſeaſes haue alſo common cauſes. *When many men at the ſame time labour of the ſame diſeaſe, wee determine that the cauſe of that diſeaſe is common.* But what cauſe may this be that is ſo common to all men? Not the ayre, for we doe not all breath the ſame ayre; one man liueth in an impure ayre, another in a pure; one inhabiteth in the North another in the South; wherefore it muſt be ſome Principle which is this common cauſe. This Principle the Arabians firſt of all men acknowledged to be the Menſtrual blood (as *Auicen*, *Auenzoar*, *Halyabas* and *Auerrhoes*) wherof the *Parenchymata* of the bowels are gathered and the particular particles of the Infant are nouriſhed. The opinion of the Arabians that they come of the impurity of the courſes.

For though this blood bee pure and laudable, yet by the permixtion of the humours which fall from all the partes of the body vnto the wombe as it were into the common poomp or ſinke it becommeth impure; whence it is that as well the ſpermaticall as the fleſhie partes beeing defyled with that corruption, are of neceſſitie once in a mannes lyfe cleanſed and depurated, no otherwiſe then VVine in the caske woorketh and cleanſeth it ſelfe.

The trueth of this opinion that it may appeare more cleare, we wil ſee what may be obiected to it, and diſcuſſe the ſame as carefully as wee can, that no ſcruple may bee lefte behinde.

The Infant is nouriſhed with pure blood. ἕλκει ſayeth *Hippocrates* in his Booke *de Natura pueri*, ἀπὸ τῦ αἱματὸς τὸ γλυκύτατον, It draweth out of the bloud that which is the ſweeteſt: and therefore there cannot any euill quality ſettle vppon the ſolide or fleſhy partes. I anſwere out of the ſixt Chapter of *Galens* firſt Booke *de cauſis Symptomatum*: That the Infant whileſt it is young and ſmall in the firſt monethes, draweth the pureſt part of blood; but when it becommeth larger then it draweth the pure and impure together promiſcuouſly: or we ſay, that the blood that the Infant draweth out of the veynes wherewith it is nouriſhed is of it owne Nature pure, but is defyled by the humours which are wont to be purged by the wombe. For *Ariſtotle* ſayeth in his tenth Booke *de Hiſtoria Animalium*, that the wombe is a ſeruile member, ordained to expell thoſe things of which the body behoueth to be purged. Reaſons to the contrary. First Anſwered.

Againe they obiect, if the ſmall poxe grow vpon the impurity of the menſtrual blood, why is not that ebullition or boyling of the bloud inſtantly in the firſt monethes when the Infant is tender and weake, and there is the greateſt diſpoſition of the cauſes mooving thereunto; but after many yeares yea ſometimes not before olde age? why doe not acute Agues or other diſeaſes which happen in the life time cleanſe the body of that corruption? Second.

Wee anſwere out of *Hippocrates*, that one age differeth from another and one Nature from another. A poyſon wil ſometimes lurke in the body more yeares then one, which in the end will bewray it ſelfe and either oppreſſe Nature or bee ouercome by it and auoided. So the virulency and poyſon of the French diſeaſe and of the Leproſie will lie hid for ſome yeares, and the poyſon of a mad dog a great while before it ſhew it ſelfe. Anſwered.

Their third reaſon is That ſome men are troubled with the ſmal pox oftner then once yea many times, and therfore they procced other-whence then from the infection of the menſtruall blood. But this is a childiſh argument; for the diſeaſe doth therefore returne becauſe haply the expulſiue faculty is weak and thereupon there remaine ſome reliques of the matter of the diſeaſe: ſo ſayth *Hippocrates* in the 12. Aphoriſme of the 2. Section. *The remaynders or reliques of diſeaſes are wont to be the cauſes of relapſes.* Third. Anſwered.

Their fourth reaſon is, the menſtruall blood is turned into the ſubſtance of the parts by nutrition; now the parts do not ſuffer any ebullition but the humors onely, it is therefore abſurd to imagine that the pox ſhould be generated of their heat or working; to whom we anſwere thus. The ſolid parts do not indeed worke or ſuffer ebullition, but they doe infect the humors with that quality which they acquire from the impurity of the menſtruall bloud, which humors boiling and being offenſiue to nature, are thruſt out into the skin; inſomuch as the parts themſelues are purged by that working which is in the blood. Fourth. Anſwered.

So muſty veſſels (ſaith *Auenzoar*) do infect the wine conteined in them, but if the wine do worke in a muſty veſſell, then it becommeth ſweete euer after.

Fift. Anſwered

The fifte reaſon is, if the poxe do ariſe out of the impurity of the Menſtruall bloode, why then are not women ouer-taken with the pox when their courſes are ſtopped? We anſwer, that the blood ſo ſuppreſſed is onely in the veins, and is not ſprinkled through the ſubſtance of the parts, and therefore doth not ſet le that malignant quality in the ſolid parts.

Sixt Answered.

Their ſixt reaſon. Why are not brute beaſts which are full of blood and haue thoſe monethly euacuations the matter you ſay of the poxe, and a working heate beſide? why haue not ſuch beaſts the pox alſo? Haply, becauſe they vſe a drier kinde of nouriſhment and beſide lead their whol life in labor and exerciſe, whence it is that the reliques of their impure blood are ſpent and euaporated. But a man in his tender infancy ſucketh abundantly, and after he is wayned neuer ceaſeth eating, and beſide the firſt ſeauen yeares of his age hee ſpendeth in great idleneſſe.

Seauenth.

Finally, ſeeing the fault of the Mothers blood hath continued euer ſince the beginning of the world, ſo that this diſeaſe ſhould haue beene the moſt auncient of all others, howe commeth it to paſſe that neither *Hippocrates* nor *Galen*, nor any of the *Græcians* did euer make any mention thereof; inſomuch that it ſeemeth to be a new diſeaſe knowne onelie to the Moores? It is not likely therefore that it proceedeth from the impurity of the Mothers blood.

Anſwered.

But we ſay that it is very likely that the diſeaſe was of old time, but becauſe men were more continent and liued in better order then now they do, it was not ſo ordinary in the former times as now it is. *Hippoc.* in his Books *Epidemion* doth often make mention of red, round, & ſmall Puſtules which he calleth *Exanthemata*; and *Ætius* in his 14. Book ſaith, that children had certaine Puſtules or whelkes which brake out all ouer their bodies. I do not therefore thinke that this diſeaſe was altogether vnknowne to the Grecians, but haply not ſo accurately deſcribed, becauſe in thoſe dayes by reaſon of their good dyet, the ſymptoms or accidents of the diſeaſe were not ſo dangerous. So euen at this day we haue knowne many full of the poxe without either Ague or vomiting, or any notable diſeaſe at all; and children oftentimes haue them and know not of it till they be gone.

Fernelius his opinion confuted.

They which referre the cauſe of the poxe to the malignant diſpoſition of the aer, are in my opinion far wide, for then we muſt needs acknowledge that the aer is alwaies infected, becauſe we ſee Children haue them at all times and ſeaſons and euery year. Neyther then would the diſeaſe haunt children onely, but olde folke alſo as the plague dooth; neither would it happen onely once in a mans life, but as often as the aer is ſo affected, as it dooth in the plague and other Epidemiall and peſtilent diſeaſes which come from the aer.

Mercurialis his opinion.

Mercurialis that learned man in an elegant Booke hee ſet out concerning the diſeaſes of children reſolueth many and thoſe very obſcure problemes of the nature & cauſes of theſe ſmall pox, but endeauouring to eſtabliſh a new and vnheard of cauſe of them, he ſeemeth to be miſtaken.

His opinion is, that the pox is a new diſeaſe vnknowne altogether to the Grecians, and that it ſprang firſt of all from the ill diſpoſition of the heauens and the aer, and raged almoſt vpon all men; who afterward being themſelues tainted, conferred the ſucceſsion of the diſeaſe vpon their poſterities. For as a gowty Father begetteth a gowty child, and a leprous father a leprous childe, an Epilepticall father an Epilepticall childe, why alſo ſhould not a father infected with this poiſonous diſeaſe communicate the ſame diſpoſition to his child? Theſe things may ſeeme to ſome very probable, but if we looke more narrowly into them, they will ſcarſe hold water as we ſay.

The firſt Reaſon.

For to knit vp all in few words, Hereditary diſeaſes are not communicated from the Father or Mother to the childe, but by ſeede. Theſe ſeeds containe in them potentially the Idea, Formes and Proprieties of all the partes. So the ſeede of an arthriticall or calculous Father hath in it the diſpoſition of the gowt or the ſtone; wherfore that diſpoſition of the pox muſt remaine in the ſolid parts of the parent. But in thoſe who haue had the poxe and are perfectly recouerd of them, there remaineth no corruption nor any ſuch diſpoſition as being wholly euacuated by critical excretion and eruption of the puſtles; otherwiſe out of doubt the diſeaſe would againe returne. How therefore ſhall they communicate vnto their children that poyſonous diſpoſition which now they themſelues haue not in their ſolid parts. Neither are all diſeaſes hereditary, but thoſe onely which are *in beeing* in a mans body, and therefore putrid Agues and ſuch other diſeaſes as happen by accident, are not

What diſeaſes are hereditary.

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communicated to the children. Now at that time when this diſeaſe firſt began to rage, it muſt needs be granted that it was as we ſay in Schooles *Morbus Ficns*, that is, a diſeaſe not ſubſiſting but breeding, hauing his hearth or ſeate in the corruption of the humours, and therefore it could not be communicated to the children. Add hereto, that if theſe things were ſo, it would follow, that as we are all once in our liues troubled with the pox, ſo wee ſhould once in our liues be troubled with the plague. For the time hath beene vvhen the plague raged ſo fierce that few men eſcaped it. As is the poxe ſo is the plague a common diſeaſe contracted from the fault and impurity of the aer, why then ſhould not our parents leaue vs alſo that vnwelcome inheritance as well as they do the pox?

Morbus Ficns.

The ſecond.

We conclude therefore with the *Arabians*, that the cauſe of the poxe is the impurity of the Mothers blood wherewith the infant is nouriſhed, which impurity it acquireth as well by his ſtay in the body beyond the limited time, as alſo from the permixtion of the humors which fall into the womb as vnto the ſinke of the body.

The concluſion with the Arabians.

QVEST. X. *Of the cauſes of the periodicall euacuation of the Menſtrua.*

ALl men know that the Menſtruall blood is purged through the wombe by certaine ſtanding and limited circuites and Courſes, but the cauſes of this returne is a very hard thing to finde out. Many do wonder why ſeeing all other excrements are euacuated euery day, this blood which is the excrement of the laſt Aliment ſhould be auoided but once in a month.

Why it is not purged euerie day.

The thicke excrements of the firſt concoction as they are daily generated, ſo they are dayly auoided. The Choller is euery day thruſt out of the Liuer into the bladder of the gall, and thence into the *Duodenum*; the vrine is daily tranſcolated from the Kidneyes vnto the bladder of vrine. So likewiſe the excrements of the third concoction, *i*, thoſe of the habit of the body are ſpent by ſweating, breathing & inſenſible tranſpiration, by the haire and the ſoile of the skin. Thoſe of the braine by the palate, by the noſethrils, the eares and the eyes; thoſe of the cheſt by coughing; why therefore is not the Menſtruall blood euery day euacuated, ſeeing it hath a continuall generation?

This I thinke is to be attributed onely to the ſingular prouidence of Nature, and to the Final cauſe the moſt excellent of all the reſt. For if the blood were euery day purged away by the wombe, then could women neuer conceiue with childe, neyther yet any man haue due and comfortable vſe of a woman. Firſt conception would be hindred, becauſe the ſeed powred out into the cauity of the wombe, would either fall backe or be extinguiſhed; the coates of the wombe being irrigated, moiſtned and as it were inebriated or made drunke by the daily affluence of the blood. So ſaith *Hippocrates* in the 62 Aphoriſme of the firſt ſection, *Thoſe women that haue moyſt wombes do not conceiue, becauſe their geniture is extinguiſhed.* Beſide, what pleaſure or contentment could any man finde in a wife ſo lothſomly defiled, and that perpetually. It was not therefore fit for the accompliſhment of the intention of Nature, that a womans blood ſhould iſſue euery day, but onely at certaine and definite times and circuites, to wit, once euery moneth.

The true reaſon.

But why this excretion ſhould be made euery moneth not oftner nor more ſeldome, is a great queſtion and I aſſure you very full of difficulty. *Ariſtotle* in the 2. and 4. *de generatione Animalium*, referreth the reaſon of this periodicall or certaine euacuation to the motion of the Moone, and ſaith; that when the Moone is in the wane womens courſes do eſpeciall flow, becauſe at that time the aer is colder and moiſter, from whence comes the encreaſe and aboundance of that colde and crude humour; but *Ariſtotle* is by ſome heerein reprehended, becauſe in the full of the Moone all things are moſt moiſte, as appeareth by Shel fiſhes, Oyſters, and ſuch like. The *Peripatetikes* anſwere, that there is a double humiditie, one viuificall or liuely, the other excrementitious. The firſt is encreaſed in the full of the Moone, becauſe then there is more light; the ſecond is encreaſed in the wane, becauſe then the aer is colder; now Menſtruall blood is generated by a weake heate.

Why it is purged euery moneth.

Ariſto. opinion

The *Arabians* thinke there are diuers times of this purgation, according to the diuerſitie of womens ages. Young women (ſay they) are purged in the new Moone, and olde women in the old moone, whence commeth that common verſe.

The Arabians opinion.

Luna vetus vetulas, iuvenes noua Luna repurgat.
Young women in the New Moone purge, Old women in the wane.

Some there are, who referre the cauſe of this circuite and monthly euacuation to the pro-

priety of the moneth, as if the month had a peculiar power to purge the courſes, as the day hath to purge the ordinary excrements. And for this we may alleadge a notable teſtimony of *Hippocrates* in his Booke *de ſeptimeſtri partu*, where he ſayeth, *In the moneths the ſame things are done by certaine and right reaſon which are done in dayes: for euery moneth hayle women haue their courſes as if the moneth had a peculiar power and efficacy in their bodies.* Wee muſt needs acknowledge that the Moone hath great power ouer inferior bodies, but that the ſole cauſe of the Criticall daies and of this menſtruall euacuation ſhould be referred to the motion of the Moone I could neuer yet perſwade my ſelfe.

A ſtrãge place in *Hippocrates.*

That many things are diſpenſed by numbers and by moneths I doe not deny; but to attribute any operatiue power to quantity and to number as it is number, I thinke is vnworthy of a Philoſopher. It is more wiſedome to referre the cauſe of this periodicall euacuation to the determinate motions and eſtabliſhed lawes of Nature to vs vnknowne, which yet ſhe neuer breaketh or abrogateth, but keepes immutable and inuiolable vnleſſe ſhe be either prouoked or hindred: for when ſhe is prouoked ſhe antiuerteth or haſtneth the excretion auoyding the bloud before her owne time. So whereas the ſeuenth dayes are only truely criticall, yet Nature indeuoureth vacuations ſometimes in the dayes betweene, yea & accompliſheth them, becauſe of ſome prouocation comming from without, that is, beſide her owne lawfull contention. Againe, being hindered either by the narrowneſſe of the paſſages, or by the thicknes of the humours, ſhe oftentimes procraſtinateth and delayeth their accuſtomed euacuation.

What wee reſolue vpon.

How Nature is prouoked.

How hindred.

Hence it is that in ſome women the courſes flow twice in a moneth, in ſome ſcarce before euery fortieth day. But why the blood ſhould flow from the wombe rather once euery moneth then twice, or why the ſeauenth dayes ſhould rather bee criticall then the ſixth ἀνθρωπίνην ὑπερβαίνουσι σύνεσιν, *is aboue the capacity of humane wit.*

Hippocrates verily promiſeth in the end of his Booke *de principiis, to make manifeſt the neceſſity of Nature why ſhe diſpenſeth all things in the ſeauenth dayes*: but I thinke he was diſwaded by the difficulty of the buiſineſſe, and therefore no where perfourmeth that promiſe. Wherefore ſeeing he that beſt could durſt not aduenture vpon it, we will alſo ingenuouſly confeſſe our ignorance and ranke theſe ſecrets among thoſe myſteries of Nature which ſhe reſerueth onely to her ſelfe, to teach vs not onely in this but in other things, to obſerue her adminiſtrations the better and to ſuſpect our owne weaknes. For wee ſee that in the moſt abiect and baſe things of the world there are ſome ſecrets of Nature whereof either we are not at all capable or not yet ſufficiently inſtructed.

Hippocrates promiſe.

Not kept.

All ſecrets of nature not to be knowne.

And thus much concerning that other principle of Generation, the mothers blood. now it followeth that we come vnto the Conception, wherein alſo we ſhal finde ſome difficulties worthy the diſcuſſing.

QVEST. XI. *Whether it is neceſſary to Conception that the Seed of both Sexes ſhould iſſue together, and that with pleaſure, and be preſently mingled.*

WEe haue already proued that both the Seedes as well the fathers as the mothers are required in a perfect Generation; but whether they ought both at once to be euacuated is not yet ſo euident. *Auerrhoes* contendeth that the eiaculation of the Seed into the cauity of the wombe is not alwayes neceſſaray, and that a woman may Conceiue without the embracements of a man. And to this purpoſe he telleth a Tale of a woman who conceiued the ſeede of a man floating in the water of a bath, ſo ſtrong ſayeth hee was the attractiue faculty of the wombe in drawing of ſeede. But it is great wonder that a Philoſopher would be ſo credulous to beleeue the excuſe of a light-skirts, who to ſaue her honeſty deuiſed this excuſe by looking vpon her apron ſtrings: for ſayth he a neighbour of mine told me this tale of her ſelfe. The woman I cannot but commend for her wit, though not for her honeſty: but *Auerrhoes* had forgot what his maiſter *Ariſtotle* taught him in his ſecond Booke *de Generatione Animalium*. Seede ſayeth he is altogether aerie, frothy, and if it be expoſed to the ayre it preſently melteth, groweth wateriſh and becommeth vnfruitful. In the fixt Chapter alſo of his firſt Booke *de Generatione Animalium*, he writeth that thoſe creatures which haue long yards or virile members are therefore vnfruitfull, becauſe in the length of the way the ſeede is refrigerated. If therfore it may be refrigerated in his firſt and natural conceptacle, much more being expoſed to the ayre or loſt in the water.

Auerrhoes opinion of the eiaculation.

How finely he was gulled by a light skirts.

Auerrhoes diſproued.

Firſt reaſon.

Second reaſon.

Thoſe which are called ὑποσπαδίαιοι whoſe common paſſage of ſeede and vrine is turned

ned aside, by reason that the yarde is too hard reined with the bridle, cannot generate, not because they haue not fruitfull seede, but because hanging a little in the contortion of the yard, it cannot immediately be conueyed into the wombe whilst it reteineth his heat and spirits, as saith *Galen* in the 3. chapter of his 15. Booke *de vsu partium.*

Doth not *Hippocrates* in his first Booke *de Morbis mulierum* affirme that to be a cause of sterility and barrennesse in women when the womb is peruerted or distorted, because then the seede cannot directly passe without delay vnto the inner orifice of the same? It is therefore necessary O *Auerrhoes* that there be a direct and impetuous or forcible eiaculation of the seede of the man into the wombe of the woman. Furthermore, because in brute beasts which couer one the other, the eiaculation of the seede into the wombe is more direct, it commeth to passe that at once couering for the most part they holde as we vse to say, which is not so betwixt reasonable creatures. Againe, beastes are quiet in that action, being so taught by Nature, for motion often preuenteth conception.

Third reason.

Why Beastes conceiue at the first.

Now, if at the same time both sexes yeelde their seede, then is the conception sooner, and also more perfect, because the wombe at that time being as it were enraged, dooth more greedily draw and more narrowly embrace the seede which is cast vnto it. This *Hippocrates* acknowledgeth in his first Booke *de morbis Mulierum* in these words; *If that which proceedeth from the man, doth together and in a right line concurre and meete with that which is auoyded by the woman, then doth the woman sooner conceiue*, he saith ἐμόῤῥοθῶν, by a Metaphor taken from Water-men, who together do rise vpon their Rowers, together dip them in the water, and together driue their stroke. And whereas he saith that they *sooner conceiue*, it is an argument that it is not of absolute necessity vnto generation, that both sexes shoulde at one and the same time yeeld their seeds; but that there may be conception though it bee slower, if one come a little before or after another; but if the distance of time bee too great between them then the conception succeedeth not, because the spirits of the first seede are exhausted and disipated.

It is not necessary that the eiaculation of both seeds should be at once.

The same thing hath *Aristotle* in his tenth Booke *De Historia Animalium*, vppon which *Scaliger* hath written an excellent Commentary, as that mirror of Learning did all things excellently: There are (saith he) that think, there can be no conception vnlesse the seedes of both sexes do at the same time meete one with another; these are deceiued, because the better habited body sooner yeeldeth, wherefore that seed being the stronger, is not corrupted but reteineth his spirits, and being drawne by the wombe, is reteined for the future permixtion, so that to conception simply this concurrence of seeds at one and the same time is not absolutely, but to a sooner conception it is necessary.

Proued by *Aristotles* authority.

It is also demanded, whether conception may bee without pleasure. On the mans part there is no question, but on the womans; for you shall heare many say that they haue no sense or inkling of pleasure at all. *Dinus* is of this minde that conception is not alwaies with pleasure on the womans part; but *Dina* were a better iudge of this controuersy: let vs heat his reason, because sometimes (saith he) the seede is immediately eiaculated into the bottome of the wombe which is of a duller sense, neuer touching the orifice whose sense is more exquisite. A pretty shift I promise you, but the good man was in an error. For pleasure is not therefore conceiued because the seede toucheth the orifice of the wombe, but because it runneth through the spermaticall vesselles of the woman which are of exquisite sense, otherwise women with childe who eiaculate their seede not into the inward orifice, but into the middle of the necke of the wombe, should haue no pleasure in such eiaculations; but it is manifest that they haue greater pleasure after they bee with child then before, because their seed passeth a longer course, as we shall say more at large in our Discourse of Superfœtation.

Whither conception may be without pleasure.

Dinus opinion Confuted.

Hippocrates in his Booke *de Principijs* assoileth this question. For after hee hath giuen vs some signes of conception he saith, that these do not happen to all women, but vnto those onely whose bodyes are pure and cleane; but where the body is grosse, full of mucous and impure humors, there are no such signes. That is to say, an impure, mucous and moyste woman may conceyue without pleasure, or any sence of titillation at all.

The question assoyled by *Hippocrates.*

Finally, some doubt whether the permixtion of the seeds bee requisite to conception, because it is absurd to thinke that species or kinds are mixed: againe, if they be mixed then should essenties be intended and remitted, which in Philosophy is a grosse absurdity, because euery essence is impartible. Likewise of two beings by themselues, one being by it selfe cannot be made. But we answere, that the Seeds being not actually animated, they do

Whether the seede of both sexes be mingled. Obiections. Answered.

doe not of themselues make the *species* of the Creature. If it bee granted also according to *Aristotle*, that they are imperfect essences or beings, it is necessary that they should bee mixed, otherwise they cannot bee nourished or animated together as *Hippocrates* sayeth in his Booke *de Natura pueri*. And in his first Booke *de diæta*, he blameth them that doubt whether of two fires a third may arise. *If any man sayth he deny that a Soule is mingled with a Soule*, that is, one seede with another, *let him be held for an Idiot in Physicke*. And in the very beginning of his Booke *de Natura pueri*. *If the geniture proceeding from both the parents be retayned in the wombe of the woman they are presently mixed into one.* And thus much of the effusion of the seedes of both Sexes, the pleasure thereuppon conceiued, and the permixtion of the seeds themselues.

Aristotle.

Hippocrates.

QVEST. XII. *Whether the wombe haue any operatiue or actiue power in the conformation of the Creature.*

A double agent.

IT wil not be hard to vntie this knot. According to the Philosophers rule there is a double agent, one Principall another Helpfull or assistant onely. A principall agent no man will say the wombe is, because then a woman could conceiue alone without the helpe of the man, and besides Females onely, Males neuer should be formed. The wombe therfore worketh as *Causa sine qua non*, a cause not so much of the being, as without which it could not be; because it awaketh and stirreth vp the sleepy and hidden vertue of the seede. The Physitians make three kindes of Efficient causes. Principall, Helping, or that without which a thing cannot be done.

3. kinds of Efficent causes among Physitians.

So in Purgations the principall cause is the propriety of the medicine, the Helping cause is the hot Temper; the cause *sine qua non* is our naturall heate, without which the power of the medicine being drowsie would neuer be brought into act. So in the conformation of the Infant, the principal cause is the Seed, I meane the spirits of the seed, by which as by workemen the Soule which is the noble and chiefe Architect frameth a mansion fit for the performance of her different functions. The Helping cause is a laudable Temper of the seedes and of the wombe. The *Causa sine qua non* is the wombe. For because the seeds are not actually Animated but only potentially, they need another principle whereby their power may be brought into act: the wombe therefore worketh diuerse wayes. First of all it draweth the Seede of the man through the necke, no otherwise then a Hart draweth a Snake by his nosethrilles out of the earth. For the seede is not powred into the cauity of the wombe as some of the Auntients thought but into the necke thereof. The bottome therefore of the wombe meeteth with the Seede halfe way, and with his inward mouth as with a hand it snatcheth it vnto it selfe and layeth it vp safely in her bosome. And euen as, sayeth *Galen* in his first Booke *de semine*, a hungery stomack runneth with his bottom euen vnto the throate to snatch the meate out of the mouth before it be halfe chewed; so the wombe which is the very seat of Concupiscence, being desirous and longing after the seed, moueth it selfe wholly euen to the priuities, and this is the first action of the womb, to wit, the traction of the Seede of the man.

How many wayes the wombe worketh.

First by traction.

2. By mixtion. The second action of the wombe is the permixtion of the seedes; now they be mixed either by themselues or by another; not of themselues because they are not alwayes auoided at the same time, as we haue in the question before going proued out of *Hippocrates* & *Aristotle*; neither yet are they eiaculated into the same place, for the mans seede is cast into the neck of the wombe, the womans into the sides of the bottome which we call the horns of the wombe: the wombe therefore maketh this permixtion of the seedes which the Barbarians call *Aggregation*.

3. By retention. The third action of the wombe is the Retention of the seedes, in which the woman feeleth a manifest motion of the wombe: for it gathereth, crumpleth and corrugateth it selfe, and so exquisitly shutteth his orifice that it will not admit the poynt of a Probe.

4. By conception. The last action of the wombe is the suscitation or raising vp of the seedes which wee commonly call Conception. Now the faculty of the seed is raysed or rowsed, not so much by the heate of the wombe as by his in-bred propriety, for if the seede should be cast into any other part of the body though it were hotter then the vvombe, it would not be conceyued but putrified.

After Conception the action of the vvombe ceaseth; the vvhole processe of the vvorke of Nature, in fourming, nourishing and increasing is left vnto the Infant: this one thing the vvombe performeth, it conteyneth, preserueth and cherisheth the Infant, because the

place

the place is the preseruer of that which is placed therein.

QVEST. XIII. *Of vitious or faulty Conceptions, and especially of the Mola.*

THat Conception is made by the in-bred propriety of the Wombe, this among the rest manifestly prooueth, that into what part of the body soeuer, sauing into this, the seede is powred, this power or efficacy is neuer stirred vp, neither commeth into acte; so that conception is as properly the action of the wombe, as Chylification is the action of the stomacke. But that conception may be perfect, the seede which is yeelded and reteined must be pure and fruitfull. By pure I vnderstand with *Hippocrates*, that which is not sickly or diseased, neither yet mingled with blood. For blood is not requisite to generation till after the description of the spermaticall parts is begun; otherwise the seede being choaked by the aboundance of the blood, neither at all attempteth his worke, neither can it bring to perfection that it could haue well begun. Againe, if the seedes be vnfruitfull, what hope can there be of a harueft. What is required to perfect conception.

To perfect conception there is further required an εὐκρασία or lawdable temper of the wombe; for those whose wombes are either hot or colde, or moyst or dry aboue measure do not conceiue as saith *Hippocrates*. If therefore any of these things be wanting, wee cannot hope for a lawfull conception, but either there will bee none at all, or a depraued and vitious, such as is of the Moone-calfe or *Mola*. For Nature rather endeauoureth an imperfect and depraued Conception then none at all, because she is greedy of propagation and diligent to maintaine the perpetuity of the kindes of things: wherefore rather then she will do nothing, she will endeuour any thing how imperfect soeuer. So when Nature maketh wormes in the stomacke and guts, she doth better then if she should generate nothing at al, because of a thing immooueable she maketh a thing mooueable by it selfe and of it selfe, & of a putrid and rotten humour an animated creature. Nature endeuoureth a depraued conception rather then none & why.

The nature and causes of this faulty conception which they call the *Mola* or Moon-calfe we will endeauour to finde out. The *Mola* the Grecians call μύλην ἢ μυλικὸν, some think that the name came from a Bakers Mill, because it is like thereto both in hardnesse & in roundnesse. Among the Persians the word *Moli* signifieth a deformed thing. *Affranius* the Poet calleth it *Molucrum*, *Aristotle* often Μόλυνσιν, because it is like a parboyled thing. We call it *A Moone-Calfe*. *Galen* in the 7. Chapter of his 14 Booke *de vsu partium*, defineth a *Mola* to be σάρκα ἀργὴν ἢ ἀδιάπλασον, that is, an *Idle and imperfect flesh*. But this definition dooth not expresse the whole Nature of the *Mola*. For there may bee a rude flesh generated without motion, which is not a *Mola*. There are euery where Caruncles generated, which no man wil call Moles. We thinke that this rather is a perfect definition of a *Mola*. *The Mola or moon calfe is an idle flesh without forme and hard, engendred onely in the wombe of a woman, and that of weake seede, which seede vndertaking the Conformation, but beeing oppressed or stifled vvith aboundance of blood, it cannot atteine his owne end, and therefore in steade of a creature generateth a lumpe of flesh.* The names of the *Mola*. *Affranius*. *Galens* definition. A perfect definition of the *Mola*.

The particular parts of this definition we will discourse of and discusse in order. The *Mola is a flesh*, because his substance is fleshy and red like clodded blood. *It is Idle*, that is, without any Animall motion; for it is not at al moued vnlesse it be after the motion of the wombe. It is *rude without forme*, not that it wanteth his owne forme, for it hath as saith the Philosopher his owne being, but it hath neyther εἶδος nor μορφήν, that is, neither the species nor the forme of a creature. *It is engendred onely in the wombe of a woman*, because as writeth *Aristotle*, onely a woman hath aboundance of menstruall purgatoins, for that her diet is moist, and her course of life sluggish and idle in respect of other creatures. That which is obiected of the Beare which alwayes bringeth foorth her young rude and vnformed, and perfecteth them by licking, either we say it is a Fable, or else that their young doe appeare deformed or vnformed but are not so indeede, but because they lurk all winter in the caues of the earth, they are couered with a slimy and Flegmaticke moysture which the Dam licking of makes their proportion appeare. Flesh. Idle. Rude. Onely in a woman.

The rest of the parts of our definition, doe fully declare the manner of the generation, and the causes of the *Mola*. I know there are diuers opinions of the Ancients concerning their generation. *Plutark* saith that a *Mola* may be generated without the cõpany of a man, whom many follow, who thinke it may be generated onely of the seed of the woman, when to it a great quantity of her bloode accrueth. But this opinion is disproued by *Galen* in *Plutark* of the *Mola*. Disproued.

the

the 7. Chapter of his 14. Booke *de vſu partium*, where hee ſaith that among all creatures which walke continually vpon the earth, none doe euer conceiue without the ſeede of the Male, no not a faulty or vitious conception; becauſe all beginning of conformation proceedeth from the ſeede of the Male as that which is the firſt principle of Generation. Add hereto that if a *Mo'e* could be conceiued onely of the ſeede of the woman, then thoſe Virgines which doe ſuffer nightly polutions might conceiue the ſame which neuer yet was hard off.

Mercurialis his opinion.

Re'elled.

The Coagmentation therefore of the Mole is neuer made without copulation. Some thinke that the Mole is generated as other fleſh, onely by the affluence of aboundance of bloud which is gathered or caked together by the heate of the wombe. But becauſe the blood hath no actiue or operatiue power but onely paſsiue, I doe not ſee how a Moale can be made onely of bloud, when as we ſee it is tyed with ligaments to the wombe and inueſted with membranes, which ligaments and membranes are the rudiments of a conformation inchoated or begunne. Neither are wee to giue credite to them that affirme that it is generated onely of crude and corrupted ſeede, or when the ſeede of the woman ouercommeth the Seede of the Male. The true manner of their Generation *Hippocrates* ſetteth downe in his firſt Book *de morbis mulierum*, which, becauſe we eſteem it as an Oracle, I wil here tranſcribe. *Concerning the Conception of the Mola this is the very trueth: when a great aboundance of bloud cloyeth a little ill diſpoſed ſeede there cannot bee a lawfull conception, yet the belly ſwelleth as if the woman were with Child.* What could be ſayed more ſuccinctly, what to better purpoſe?

Hippocrates opinion.

Explayned.

Two things he requireth to the Generation of the *Mola*: Firſt that there be the Seede of the man; but that in little quantity and vitious or faulty. Secondly that great quantity of blood ſhould flow vnto it. That little and vitiated ſeede vndertaketh the worke of conformation and beginneth to forme the membranes; for almoſt all Moone-calues are couered with filmes and membranes.

The maner of the generation of the *mola*

But when as the ſeede thus little and weake endeuoureth to perfect his woorke hee hath begun, then is the diſcretion or ſeparation of the parts hindered and interrupted by the affluence of too much blood, & the Conception becommeth illegitimate, becauſe the blood beareth greater ſway then the ſeede; ſo that in ſteade of a liuing Creature which was the firſt intention of Nature, there is generated an vnformed & rude maſſe of fleſh hauing indeede the principles of Life, but thoſe ſo weake that they are preſently ſuffocated and extinguiſhed. For whereas it dayly groweth and encreaſeth that commeth not by true nutrition but by appoſition onely.

Some thinke that this fleſh is not altogether without life, but ἡμίζωον as if they ſhould ſay it had halfe a Soule. It is therefore *Hippocrates* reſolution that the *mola* can neuer bee generated without the ſeede of the man, and that the beginning of the coagmentation or gathering of the ſame is alwayes from that ſame ſeed. The very ſame thing *Actuarius* confirmeth by this definition. *The Mola* ſayeth he, *is a fleſhy tumor which hath his beginning and his firmeneſſe or faſtneſſe from prolificall Seede.* And thus much ſhall haue been ſufficient to haue ſayd of the Nature and cauſe of the *Mola*.

Actuarius definition.

The ſignes to diſtinguiſh a *Mola* from an Infant out of *Hippocrates*.

Now let vs acquaint you by what notes and ſignes it may be diſtinguiſhed from a true Conception. *Hippocrates* in his firſt Book *de morbis mulierum*, and in his Book *de Sterilibus* conceiueth that the ſignes of the *Mola* are fetcht from theſe foure. The tumor or ſwelling of the belly, the motion, milke and the time of the geſtation. For the firſt, the belly ſooner ſwelles vpon the conception of a *Mola* then of an Infant; beſide, it is ſtiffer ſtretched and carried with more difficulty. For the motion; if after the third and fourth moneth the woman feele no motion the Conception is faulty; for ſayeth *Hippocrates* Male Infants do moue the third moneth and Females the fourth.

The tumor of the belly.

The motion.

But the *Mola* is altogether immoueable vnleſſe it be accidentally moued together with the wombe: and if a woman in that caſe feele ſometimes a trembling and panting motion, wee ſay it is not ſo much cauſed by the *Mola* it ſelfe, as from the wombe which ſtriueth to ſhake off ſo vnprofitable a burthen. Beſide, the motion of the *Mola* and the Infant is altogether vnlike: for the Infant of it owne accord turneth himſelfe and mooueth euery way, the *Mola* like a bowle or vnwealdy bulke is rowled to the right ſide or to the lefte as the wombe doeth incline to either hand. A *Mole* preſſed with the hand giueth way inſtantly but preſently returneth thither againe: the Infant as it yeeldeth not preſently, ſo after it hath giuen way it returneth not into the ſame place and poſition againe.

The

The third signe of the Mole *Hippocrates* taketh from the Nature of the Milke. *This is the greatest and most certaine argument of the Mola, if there appeare no Milke in the Pappes*. But if the Conceptions be legittimate there is milke. For this we haue a Golden saying in the Booke *de Natura pueri*, *As soone as the Infant beginneth to mooue, euen then the Milk bewrayeth it to the mother*. But if a *Mola* be conceyued there is no Milke generated. Amongest all the rest, there is indeede no signe so infallible as that which is fetched from the time of the Gestation. For, if the Tumor of the belly continue after the eleauenth month which is the vtmost limit of Gestation, and yet there appeare no signes of a dropsie, wee may bee bold to say, it is not an infant but a *Mola* that is conceiued. And *Hippocrates* saith, *That a woman may beare a Mola two yea three yeares*.

3. signifi from the Milke. *Hippocrates.*

Aristotle also in the 7. chapter of his fourth Booke *De generatione Animalium* saith, that a Mola may endure in a womans body foure yeares, yea the whole course of her life, so that she may grow old with it, yea and dye with it of another disease; and in the tenth Booke *De Historia Animalium* he rendreth the reason; because (saith hee) being no creature it vrgeth not the wombe neither mooueth therein as doth the childe, who by kicking seeketh a way out for himselfe. Moreouer, the *Mola* breatheth not, neither needeth any aer at all, and therefore seeketh not passage for it.

A Mola may lye long in the womb & why.

The late Writers add, that the woman which hath conceiued a Mola becommeth pale, looseth all her colour, yea and pineth away in her whole body. And thus much of the *Mola* his nature, and the signes whereby it may bee distinguished from a Lawfull Conception.

QVEST. XIIII. *Of Monsters and Hermophradites.*

TO depraued and illegittimate Conceptions must Monsters be referred, concerning which, it shall not be out of our way to giue you some briefe Notice. Monsters *Aristotle* calleth Excursions and Digressions of Nature, taking his Metaphor from Trauellers, who wander out of their way yet go stil on their intended iourney. For when Nature cannot accomplish and bring to perfection that shee intendeth, least she should be idle, which is a thing incompetent to her disposition, she doth what she can. And in the second Booke of his Physickes, he defineth a Monster to be a fault, or error, or præuarication of Nature working for some ende of which she is frustrated because of some principle corrupted.

The definitiō of a Monster.

Monsters happen many wayes, and there are of them innumerable differences. We will onely handle the chiefe in this place, because haply in another work we may be in this kind more particular. Monsters happen either when the sexe is vitiated, or when the Conformation is vnlawfull. In the sex, when they are of an vncertaine sex, so that you may doubt whether it be a male or a female or both, as Hermophradites. Bi-sexed Hermophradites they call *Androgynas*, *διφυεῖς, ἀνδροθήλυας ἀρσενοθήλυας*. In males that commeth to passe three manner of wayes. When in the *Perinæum* or *Interfæminium*, that is, the place betweene the cod and the fundament, there appeareth a small womans priuity; again, when the same happeneth in the cod but without any auoyding of excrement by it; and thirdly, when in the same place the vrine issueth. In females there is but one manner, when a yard or virile member beareth out in the bottome of the share-bone aboue the top of the genitall in the place of the *Clitoris*. Some add in men, when there appeareth a small priuity of a woman aboue the roote of the yard. In women, when a yard appeareth at the Leske, or in the *Perinæum*.

The differences.

Monsters in sexe.

How manie kinds of Hermophradites.

In conformation Monsters are more ordinary. To Conformation we referre Figure, Magnitude, Scituation and Number. In Figure Monsters happen: if a man haue a prone or declining Figure like a bruite beast, if he haue the face of a Dogge, of a VVolfe, a Fox, a Toad, or such like. In Magnitude Exceeding or Deficient: if there be an vnequal proportion of the parts as a great heade, or againe so little that it agreeth not with the rest of the parts. In Scituation, as if the eyes be in the middle of the forehead, the Nosethrilles in the sides, the eares in the nowle, or such like. In Number Exceeding, as when it is diuided into two bodies, two heads, foure armes, or such like; or Deficient, if it haue but one eye, no eares, and the like.

Monsters in conformation

In Figure.

Magnitude.

Scituation.

Number.

Concerning the causes of Monsters, diuers men are of diuers mindes. The Diuine referres it to the iudgement of God, the Astrologers to the Starres: *Alcabitius* saieth, there are certaine degrees in which if the Moone be when a child is conceiued, the birth becom-

The Causes of Monsters.

meth

commeth monstrous. We list not to exclude the iust vengeance of Almighty God, which no doubt hath a great stroake in these things; but to speake as a Physitian or Naturall Philosopher, it must be granted that all these aberrations of Nature are to be referred vnto the Materiall and Efficient causes of generation. The Matter is the seede, the Efficient or Agent is either Primary or Secondary. The Primary or principle cause is double. The formatiue Faculty and the Imagination. The Secondary is the instrument, to wit, the Place and certaine qualities as heate. The matter is in fault three wayes. For it is either Deficient or Aboundant, or is diuersly mixed. If there be want of Spermaticall matter, then the Monster is deficient either in Magnitude or in Number. If there be ouer plus of Seede, they become double-headed, with foure armes, &c. If there be a confused permixtion of the seede, then are Monsters generated of diuers kindes: as vpon Sodomy and vnnaturall copulations of men and beasts horrible Monsters haue beene brought into the worlde; so *Aristotle* saith, that in Egypt and Affrica, where Beasts of diuers kindes meete at the waters of *Nilus*, or in the Desert-places and mis-match themselues, there are often manie Monsters generated. And thus come monsters arising from the Matter. From the Agent or Efficient monsters may happen diuers wayes. The Primary Agent as we saide, was eyther the Formatiue Faculty or the Imagination. The power of the Imagination wee shall shew a little after in a fitter place, heere it shall bee sufficient to shew out of the learning of the Arabians, that a strong Imagination is able to produce formes euen as say they the superiour Intelligences in the Heauens do produce the formes of Mettalles, Plants, and creatures.

The true causes.

Monsters frō the matter.

Why so many Monsters in Egypt & Affrica.

The differēce of Monsters from the Efficient.

We reade that in the precinct of *Pisa*, a woman brought foorth a female childe full of haire like the haire of a Camell, because (saith the Author) she was wont to kneele before the picture of *Iohn Baptist*, cloathed in Camels haire. The Secondary Agent is the Heate or the place of Conception. Heate hauing a fiery mobility or quicke motion, formeth sundry shapes of bodies and worketh the matter into diuers fasnions. The peruersion also, the euill Conformation of the place, that is, of the wombe, may be the cause of a depraued figure. And thus I make an end of this common place at this time, wherein my purpose was onely to touch the heads of things, reseruing my selfe to heereafter for the particular prosecution. Hitherto we haue intreated of the difficulties which might arise concerning the Conception, now it followeth concerning the Conformation.

A Historie.

QVEST. XV. *Whether all the parts are formed together.*

The difficulty of the questiō.

THis question is so hard and ful of obscurity, that *Galen* saith it is only known to God & Nature. For what is more Diuine then the first Conformation of a man? What more admirable? What more secret? This the kinglie Prophet inspired from aboue acknowledgeth, *I wil confesse before thee O Lorde, because I am wonderfull made, thy eyes saw mee before I was shaped, &c.* Seeing therefore the resolution of this question is aboue the reach of humane capacity, which God wot is circumscribed within very narrow limits; if to make some ouerture thereof I shall take a little more liberty to my selfe, I desire all those that desire with mee heerein to be informed, not to impute it to my wandering wit but to the greatnesse of the subiect. Because therefore as by the Collision of stones fire is beaten out, so by the ventilation or skirmish of aduersary opinions the truth comes best to be knowne, we will first with your patience see what the Ancients haue conceyued of this matter.

Alcmæon thought, that the braine was first of all formed because it is the seate of reason and the habitation of the soule, as also for that in infants the heade is greater in his proportion then any other of the parts. It may be he had reade in *Hippocrates* his *Epidemia*, that the magnitude of the bones and of all the parts is to be esteemed according vnto the magnitude of the head, as if all the rest were formed by the heade, and had dependancie therefrom.

Alcmeons opinion.

Galen in the second Chapter of his sixte Booke *de Placitis Hippocratis & Platonis* remembreth that *Pelops* taught publickly that all the vessels had their originall from the braine; the same also was the opinion of that *Persian* Philosopher whom *Auicen* calleth *Theseus Persæus*; others *Syamor Cabronensis*.

Pelops.

Theseus or *Syamor.*

But because the braine is onely the author of sense and motion, and the principal Faculties which the Infant hath no neede of in his first Conformation; I see no reason why the braine should be formed before the other spermaticall parts.

Demo-

Democratus as *Aristotle* sayeth in the first Chapter of his second Booke *de Generatione Animalium*, did think that the outward parts were first formed, & afterward the inward parts, as Artificers are wont first rudely to frame the modell of Creatures in wood or stone before they cut out the more curious lines. *Orpheus* thought that a creature was formed as a net is knit, that is in order; *Empedocles* that the Liuer was first formed; the *Stoycks* all the parts together. *Aristotle* in his second Booke *de Generatione Animalium* sayeth that the heart is first of all formed, and by and from it all the partes are produced, which as a childe enfranchised by the father, taketh vpon him to rule and dispence the whole body. This sayth hee is the first and onely principle, the first liuer, the first moouer, the first that maketh blood, because it dyeth last of all, now that that dyeth last liueth also first. That the heart dyeth last, beside that wee are taught it by dayly experience, *Galen* also confesseth as much in the first Chapter of his sixt Booke *de locis affectis*, Death neuer followeth, sayth he, vnlesse the heart be first affected with an immoderate distemper. It is therefore necessary that the Father or Lord of the family which is the Heart, should bee created before the Cater or Steward which is the Liuer. This opinion of *Aristotles*, *Auicen* the prince of the Arabian Family seemeth to follow, which also hee establisheth by some reasons; because the creature cannot be nourished vnlesse he liue and participate of the influence of heat, now the heart is the plentifull fountaine of naturall heat.

Democratus.

Orpheus. *Empedocles.* *Aristotles* opinion.

The heart dyeth last, after *Gal.* & *Arist.*

Auicens opinion.

Againe, in the first dayes after Conception the Formatiue faculty needeth no nourishment, because there is no notable resolution or expence in the parts; but of heate and vitall spirits there is alwayes neede, therefore it was necessary that the heart should bee formed before the Liuer.

But this opinion of *Aristotles* is long since cast out of the schooles of Physitians. For that it is not the onely nor the first principle we haue already prooued sufficiently in the second question of the Controuersies of the first Booke. Nowe that it is not first generated may be demonstrated both by Reason and Sence, which two are the most vnpartiall Iudges of all Controuersies. By Sence because there alwayes appeare together and at once three bubbles, which are the rudiments of the three principal parts, neither did any man euer obserue one of those bubbles only.

Aristotles opinion confuted.

By sence.

By reason, because in the first dayes after Conception the *Embryo* needeth not the help of the heart. For liuing the life only of a plant, it needeth neither pulsation or spiration nor the influence of heat, because it cherisheth himselfe with his owne heat and with his owne inbred spirit. And wheras *Aristotle* would conclude it to be the first that liueth, because it is the last that dyeth. We say that followeth not: for those things that are first in Generation are not alwayes the last in dissolution.

By reason.

So in the Generation of any thing that is mixed, the matter goeth before the forme, and yet the abolition of the forme is the corruption of the thing mixed. By this reason also in Snakes and Serpents the tayle should be that which liueth first, because when all the other parts are starke dead and immouable, yet the tayle liueth and moueth. We think indeed that the heart is last of all depriued of life, because when the Infant is perfected and absolued the vitall heate floweth onely from the heart as from a most plentifull fountaine, but that it first liueth we vtterly deny; because to liue is either to be Norished or to be Animated. The heart is neither first nourished nor first animated. All nourishment is by blood, blood is not but by the veines, all the veines are from the Liuer; and the Vmbilicall veine which is the first Nurse of the *Embryo* powreth the blood into the *Parenchyma* of the Liuer before that of the heart. Neither is the heart first animated because the seed when it breaketh into act. *i.* when it beginneth the conformation is wholly & actually animated. Therfore all the parts thereof doe actually liue onely by the participation of heate in the moysture. Wee bid therefore adue to *Aristotle*, *Chysippus*, the *Stoyckes* and whosoeuer else doe thinke that the heart is the first liuer and the first maker of bloud.

That the hart doth not first liue.

What it is to liue.

Galen seemeth to differ from himselfe in the order of the conformation of the parts, for sometimes he sayeth that the Heart and the Liuer are formed together, somtimes that the Liuer is first formed, sometimes that the vmbilicall veine hath the preheminence; yet herein he is alway of one minde, that he thinketh the partes are generated in succession, not at once and together. And this he illustrateth by examples of those things that are wrought by Art. For a house is not built all at once, but first the foundations are layde, then the walles are reared, and finally the roofe is layd on: so sayeth he it is in the Infant, one part is formed before another, to wit, that first which is most necessary for the *Embryo*. And that he

Galen in this is diuers.

The parts are generated successiuely.

he thinketh is the Liuer, becauſe the Infant liueth at firſt the life of a plant needing onely nutrition as doth a plant; now the Liuer is the ſhop or ſtorehouſe of Aliment. As therefore a plant hath no need of a heart, ſo neither the Infant in the beginning.

Moreouer that the Liuer is firſt generated may be proued by his magnitude and the facility of his generation, for it is made onely of congealed bloud; adde hereto that the vmbilicall veine atteyneth to the Liuer before it commeth to the Heart. That all theſe things are true *Galen* teacheth in the third Chapter of his Booke *de formatione fœtus*, becauſe in Infants the natural faculties as being the firſt of all other are the ſtrongeſt, thoſe that riſe from the Heart much weaker, thoſe weakeſt of all which come from the Brayne. Furthermore all Generation proceedeth from that which is more imperfect to that which is more perfect: wherefore firſt is the liuer generated, then the Heart and laſt of all the Brayne. This is the opinion of *Galen* and almoſt of all Phyſitians both old and new concerning the conformation of the parts.

Galen.

We for our owne part doe not vſe to ſweare vnto the opinion of any man, but as wee eſteeme much and haue in great reuerence the patrons and founders of our Art, as becommeth vs well; ſo if at any time they ſtray from the rule of right reaſon, wee ſhall not make ſcruple to diſſent from them. VVhatſoeuer therefore *Galen* may think, we cannot be perſwaded that the Liuer is firſt formed, becauſe before the delineation of all the parts of the Infant hee needeth not the helpe of the Liuer; for it was not behoofefull that the blood ſhould flow till after the diſcretion and diſcription of the ſpermaticall parts, otherwiſe the ſeede would be cloyed and clogged with blood and inſtead of a lawfull Conception a *Mola* would be formed.

Galens opinion not to be approued.

The reaſons.

As for that nouriſhment and encreaſe which *Galen* feygneth ſhould bee made by the blood, we are ſo farre from thinking it neceſſary to the firſt conformation, that we rather thinke with *Hippocates* and *Ariſtotle* that it would haue beene a great hinderance thereto, ſo that we may retort *Galens* weapon which he vſeth againſt *Ariſtotle* vppon himſelfe. The Infant ſayth *Galen* needeth not the helpe of the heart, therefore the heart is not formed before the Liuer. VVe ſay, the Infant needed not the helpe of the Liuer becauſe it is not nouriſhed till after the delineation of the ſpermaticall partes is abſolued, wherefore the Liuer ought not to be formed before the Heart and the Brayne.

Obiection. Solution.

You will obiect for *Galen* that life is limited and defined by nutrition, if therefore the *Embryo* doe liue it needeth to bee nouriſhed. I anſwer, that in creatures that are perfect nothing liueth that is not nouriſhed, but imperfect creatures and ſuch as are without bloud may liue a time without nouriſhment, ſo ſome creatures liue al winter in holes and a plant all winter is not nouriſhed, but viuifieth and quickneth it ſelfe. The tender *Embryo* therfore which is without blood liueth the firſt dayes and yet is not nouriſhed, becauſe there is no neceſsity of nouriſhment ſeeing there is no exhauſtion of the parts.

What we thinke.

It remayneth now that we make manifeſt vnto you our own conceit of the order of Conformation, which we will doe as briefly and perſpicuouſly as poſsibly wee can: but becauſe we would haue euen the moſt ignorant conceiue vs the better we wil vſe firſt theſe diſtinctions.

Differences of the parts of the infant.

Of the partes ſome are proper to the Infant it ſelfe of which it hath vſe in the whole courſe of his life; others are ſeruiceable vnto it onely ſo long as it abideth in the mothers wombe, of which kinde are thoſe skinny couerings and ſmall membranes compaſsing the Infant about. Againe we muſt obſerue thus much, that ſome partes are ſpermaticall engendered of the craſſament of the ſeed, others fleſhy whoſe originall is immediately from the bloud. And of theſe fleſhy parts there are three kinds as there are three kinds of fleſh. For it is either the fleſh of the bowelles which wee call *Parenchyma* or the fleſh of the muſcles, which *Hippocrates* properly and abſolutely tearmeth σαρξ, that is *Fleſh*, or the peculiar fleſh of euery part which hath not any proper name.

The membranes firſt generated.

Theſe things being thus, we conceiue. That the membranes called *Amnion* and *Chorion* are firſt of all formed, becauſe the inward and moſt noble part of the ſeede was to bee defenced and walled about with theſe curtaynes, as we ſhall ſhew more diſtinctly in our next exerciſe.

All the parts formed together.

Theſe coates being formed, we thinke that the rudiments or *Stamina* and threds of all the ſpermaticall parts are formed together at once, becauſe the matter is the ſame, alike altered and diſpoſed by the heate, the workeman the ſame to wit the ſpirit diffuſed through the whole maſſe of the ſeed, the Finall cauſe the ſame, that is, the vſe of euery ſingular part.

For

For, seeing that in the first delineation the Infant needeth not eyther the nourishment of the Liuer, or the influence or pulsation of the heart, or the sense of the braine, but cherisheth it selfe with his owne in-bred heate; why should wee thinke that one of the parts is formed before another? If Nature when she vndertaketh the concoction of quitture or *Pus* which we call Matter, dooth bring the whol to an equalitie together, and insinuate it selfe equally and alike into all the parts thereof, why shall shee not in this first delineation of the Spermaticall parts (the Idea of all which the Formatiue Faculty conteyneth in it selfe) beginne and accomplish the description of all of them together? Neyther is this our opinion but the Conclusion of *Hippocrates* in his first Booke *De Diæta* and in his Booke *de Locis in homine.* *Hippocrates* opinion.

In his Booke *De Diæta*, *The partes are all delineated together, all together encreased, not one or more, before or after another or the rest, but those that are greater by Nature doe appeare before those that are lesse.*

In his Booke *De Locis in homine* straight after the beginning hee breaketh out into these wordes, *It seemeth vnto mee, that there is nothing first in the bodye, but all thinges are the beginning and all things the end, all parts first and all last.* What could he say more plainely? What more breefely? Or what indeede could bee eyther spoken or immagined more Diuine? The Flesshie parts are the last made, and their order

The Spermaticall parts therefore which we call solid or first parts, are shadowed or lined out at once and together, but afterwards they are perfected euery one in their order; First those that are more noble and necessarie, and those last which are most ignoble and lesse necessary. After the delineation of the spermaticall partes are formed the Flesshie, and first of all the *Parenchymata* of the bowelles, nexte the proper flesh of the particular parts, and finally the emptie spaces of the Muscles are filled vp.

Among the *Parenchymata* we thinke that of the Liuer is first gathered together, beecause the Vmbilicall Veyne dooth first powre the blood thereinto, which beeing concreted or caked maketh the substaunce or flesh of the Liuer; and this happely *Galen* meant, where he saith that the Liuer is first generated; so that in this sense if he spake hee may wel be excused. How *Galen* may be excused.

QVEST. XVI.

Whether the Membranes which encompasse the Infant bee first formed, and whether they bee made by the Forming Facultie, and of the Seede of the Woman.

(***)

3 Questions. The first.

That the mẽbranes are first formed.

Experience.

Oncerning the Originall of the Membranes which compasse the Infant three thinges are to bee enquired after. First, whether the Formatiue Facultie doe at these beginne the Conformation, that is, whether these bee first of all formed. Wee thinke that they are, being taught both by Reason and Experience. For Experience, wee will auouch *Hippocrates*, *Aristotle*, *Galen*, and our owne.

The *Geniture* sayeth *Hippocrates*, *After it is mixed and reteyned, what day or houre soeuer it bee auoyded, dooth alwayes appeare couered with a Filme or cruſt.* The same vvriteth *Aristotle* in his Bookes *De Generatione Animalium.* And *Galen* in his first Booke *de Semine.* I haue often seene the Geniture conceyued onely couered with Membranes.

Who euer saw a conception, although it were vitious and illegitimate which was not couered with a Filme as it were with a Garment? The Mola albeit it be verie rude & without forme, yet is it cloathed with a Membrane (a manifest argument that the Formatiue Facultie in all Conceptions beginneth her woorke with the delineation of the Membranes) where shee is hindered that shee can proceede no farther.

To Experience wee may add Reason. The Membranes were necessarily first to bee made, that the Seede heerein being encompassed might the better manifest his operations, as also that the inwarde Spirits thereof might bee kept from Disipation and vanishing away, and that rhe tender *Embryo* might not hurt his soft sides against the hardnes of the wombe.

The second question, Whether the Membranes are made by the formatiue Faculty.

Authoritie.

The second Question is more obscure and the more knurrie knotte a great deale to riue, which is, whether these Coueringes bee made by the Formatiue Facultie? Some thinke that they are generated onelie by the heate of the VVombe, and for their opinion dooth vrge *Hippocrates* Authoritie and his Reasons. For, in his Booke *De Natura Pueri* he VVriteth, that the Geniture beeing heated and puffed is compassed with a Filme, euen as Breade when it is baked is compassed with a Cruſt. Now the cruſt of breade or such like is raysed in the superficies of the Masse onely by the heate of the fire.

Reasons against it.

His reason is on this manner. The seede conteynerh in it selfe the Idea or Forme onely of those partes, from whence it floweth; but in neyther of the Parents are there any such Membranes, how then shall the Seede haue any power at all to make or forme them?

Our resolutiõ

But wee thinke that the three Membranes are generated by the Forming Facultie of the Seede, and not by the onely heate of the wombe, becauſe there is no such great heate in the wombe which in so short a time can burne or puffe the Superficies of the Seedes into such Membranes. For if the VVombe shoulde atteine vnto that degree of heate, surely there would bee no conception. So saith *Hippocrates* in his Aphorismes, *Those women who haue hot wombes do not conceiue*, becauſe when the wombe is too hot, the seede is baked and torrified.

The authority expounded

As for the aboue alledged authority of *Hippocrates*, it maketh nothing against vs; for he doth but illuſtrate an obscure thing by a similitude or comparison. as if he should say, euen as the bread is compassed with a Cruſt, so is the infant compassed with Membranes; but

that

that the maner of the generation of theſe two is alike, that he doth no where affirm: & wher as they ſay that the ſeed containeth only the *Idea* or forme of thoſe parts from which it iſſueth, and that there are no ſuch Membranes actually either in the Father or in the Mother; I anſwer that ſuch & ſo diuine are the powers of the forming Faculty, that they can diffuſe or transfuſe themſelues out of one ſeede into another. If therefore the markes which were in the body of the Grandfather do often appeare in the Grandchilde, yea in his poſterity after many degrees of affinity or conſanguinity; why ſhall not the forming Facultie of the fathers ſeede make an impreſsion in the infant of that power which the Father himſelf had when he was ſeede? Add heereto the neceſsity of the Finall cauſe. It was behouefull that the Infant ſhould be inueſted with Membranes, and therefore the noble and abſolute Architect hath made them.

The reaſon anſwered.

The third queſtion which we haue heere to diſcuſſe is, whether theſe Membranes bee generated of the mans ſeede, or of the womans. It is the olde receiued opinion, that they are generated onely of the Mothers ſeede, becauſe that is the colder and leſſe fruitefull, wherefore Nature hideth more inward the noble and eſpeciall parts of the ſeed; the more ignoble and baſe ſhe diſpoſeth on the outſide as a defence to the reſt; now the ſeede of the woman is more ignoble. Moreouer the quantity of the mans ſeede is but little and not ſufficient for the forming of the outward and inward partes both, and therefore it prayeth aide of the ſeede of the woman.

The thirde queſtion

Whether the Membranes are generated of the Mans ſeed or of the womans.

We thinke that for the moſt part the Membranes are made of the ſeede of the woman, but that they are made only thereof, that we deny. For if the ſeede of the man be ſufficient for the Generation of all the parts of the Infant, why ſhould it not alſo be ſufficient to generate the Chorion? Againe, if the ſeede of the woman doe onely generate theſe Membranes, how commeth that to paſſe which *Hippocrates* auoucheth in his firſt Booke *de Diæta*; that when the womans ſeede getteth the victory ouer the mans, there are procreated three kinds of Females. Dooth not the womans ſeede ſometimes ouercome in the permixtion of the ſeeds of the ſexes? Therefore when the womans ſeede is ſtronger then the mans, why ſhould we attribute the generation of the Membranes vnto the ſtronger ſeede, and of the whole body of the Infant to the weaker.

The reſolution.

We conclude therefore that the Membranes may bee generated of either ſeede of the male or Female but of the Female more ordinarily, and againe that of the Mothers Seede not onely theſe Membranes but alſo the Spermaticall partes of the infant may be formed.

Arantius his idle opinion.

Arantius in the Booke he ſet out of the Infant ſaith, that the two Membranes the *Amnion* and the *Chorion* are not generated before all the reſt of the parts, but that they are propagations of the inner coats; the *Amnion* of the fleſhy Membrane, and the *Chorion* of the *Peritonæum*; but this is againſt all experience and reaſon, as we haue ſufficiently ſhewed in the beginning of this exerciſe.

QVEST. XVII. *Of the Number of the vmbilicall veſſelles.*

IN the Hiſtory of the Vmbilicall veſſelles, there are two thinges obſcure, to wit; the Number of the veſſelles, and their Originall. Concerning their Number the Anatomiſts are at variance, ſome ſay there are onely three, others foure, ſome fiue. They which acknowledge three, make onely one veine and two Arteries. They which woulde haue foure, adde to theſe three the *Vrachos*, thoſe who would haue fiue, number two Veines, as many Arteries and the *Vrachos*.

Of the number of theſe veſſels diuers opinions.

We reſolue, that as well in men as in beaſts there are foure alwayes, & only foure to be found. The firſt is the veine which is the Nurſe of the *Embryo*, which alone and by it ſelfe arriueth at the Nauell from the Fiſſure of the Liuer. This veine, when it hath paſſed the Nauell is clouen into two and maketh two diſtinct channels, and theſe againe are diuided and ſubdiuided, whoſe branches being ſupported by the membrane called *Chorion*, do conioyne themſelues with the veynes of the wombe; in Sheepe and Swine by certaine rounde and Nauel-like Excreſences which they call *Cotyledones* or *Acetabula*, in Women by that bulke

Our reſolutiõ

A deſcription of the vmbilicall veine.

bulke of fleſh which the late Anatomiſts call the cake or Liuer of the wombe, but I know not for what reaſon: for I doe not beleeue ſayth *Laurentius* that the blood is prepared and boyled in that fleſh, but I acknowledge the ſame vſe of it which the Auntients aſsigned to the glandulous body called *Pancreas*, to wit, ſafely to ſuſtain and like a pillow to vnder prop the innumerable propagations of veſſels which are diſtributed through the *Chorion*. The veine therefore from the nauell to the Liuer is but ſimple and ſingle, which after it is paſſed the nauell is clouen in twaine and appeareth double. And thus are the different places in *Galen* to bee reconciled, where hee writeth ſometimes that this veine is ſingle ſometimes that it is double.

Galen reconciled to himſelfe.

The Vmbilicall arteries are two, one on either ſide, proceeding not from the heart but from the Iliack branches of the great Arterie deſcending. The fourth veſſell remayneth, and vpon this hindge is the whole controuerſie turned; the Antients called it *vrachus*, becauſe by it the Infant powreth his vrine into the membrane. Almoſt all the late Anatomiſts deny this to be in a man and ſay it is onely found in beaſtes. Yet I ſayeth *Laurentius*, haue alwayes obſerued it euen in men alſo: for that a neruous production is ledde in men from the bottome of the bladder to the nauell as well as in beaſtes, I thinke no Anatomiſt will deny. I aske therefore what vſe is there in man of this production? not onely that it may ſerue for a ligament (for the bladder is tyed and doeth adhere to the neighbour partes very ſtrongly by the interpoſition of many fibres ariſing from the *Peritonæum*) but to leade away the vrine as it doth in bruite beaſtes? And in this my opinion ſayeth the ſame *Laurentius*, I am confirmed by the Hiſtory of a wench whoſe vrine being a long time ſuppreſſed, did at laſt iſſue out at her nauell.

The vmbilicall arteries.

The *vrachus*

Proued in men.

A hiſtory out of *Cabrolius*.

This *Bartholemew Cabrolius* a moſt expert Chyrurgion, and the ordinary diſſecter to the Colledge of Phyſitians at *Monpelier* in Fraunce, hath often made mention off. *Fernelius* alſo in the 13. Chapter of the ſixt Booke of his *Pathologia* telleth the like ſtory. One there was ſayeth he about 30. yeares of age in whome the necke of the bladder was obſtructed, and whoſe vrine iſſued plentifully for many moneths together at the nauell as it had beene preſſed out, and that without any tumor, collection of water in the *Abdomen*, or any offence at all in his health: when many hereat wondered much, and I hard that when he was borne his nauill was ill tyed and euer after ſome little quantity of water iſſued that way; I conceiued that the *Vrachos* was not dryed, and that his vrine did now as it did when he was in his mothers wombe returne from the bladder to the nauill.

An elegant hiſtory out of *Fernelius*.

There are therefore foure vmbilicall veſſelles, one veine, two arteries, and the *Vrachus*; all which about the nauell doe meete and are included in a long neruous and writhen canale like a gut, which they call the rope, the tye, or the gutling. The reaſon why they are ſo encompaſſed is, that they might not part one from another, and ſo be either broken being ſeuered, or intangled if they had ſcope to intangle themſelues. Theſe foure veſſelles when the Infant is borne, as now becomming of no vſe, do degenerate into a Ligament. Yet it hath bin obſerued that in ſome after they are grown to good age, the vmbilicall vein hath beene changed into a looſe and open veine, as *Volchier Coiter* obſerued at Noriberge in a mayden of 34. yeares old.

How the 4. veſſels are tyed together.

A rare obſeruation about the vmbilical veine.

QVEST. XVIII. *Of the originall of the Vmbilicall veſſels.*

THE Controuerſie is no leſſe concerning the originall of the vmbilcall veſſels then it is concerning their number. Some think they haue their originall frō the veſſelles of the wombe, becauſe they are continuated with them, and are torne from the Infant ſooner then from the wombe. And this ſame *Galen* ſeemeth to approue in his Booke *de diſſectione vteri*. The end of that veſſell that is propagated through the wombe giueth beginning to that veſſel which is in the *Chorion*: ſo that you may ſee that theſe two are one. For they are ſo vnited by their mouths that the veine draweth blood from the veine, and the artery ſpirit from the artery. The ſame writeth *Ariſtotle* in the 8. Chapter of his 7. Booke *de Hiſtoria Animalium*: The nauell, ſayth he, is as it were the cup of an Acorn about the veines, whoſe originall is from the wombe, in thoſe creatures which haue *acetabula* from thoſe *acetabula*, in thoſe that haue them not from the veine it ſelfe. But I thinke *Galen* in this place tooke more liberty to ſpeake after the common opinion of the multitude not as himſelfe thought. For that hee might declare the continuity of the veſſelles, hee ſayth, that the end of one veſſell is the beginning of another. A beginning I ſay not Phyſicall or Originall, but Mathematicall, that is, quantitatiue

Galen expounded.

Ariſtotle.

Gal. excuſed.

titatiue, as the Barbarians speake. Some there are who thinke, that the vmbilicall veines and arteries are first of all generated, and that all the rootes of the Veines and Arteries yssue from them, because the Veines proceede from the Liuer and the Arteries from the hart; now the vmbilicall veine is generated before the Liuer; for his *Parenchyma* is not gathered without blood, and blood is not deriued but through Canales, and therefore it was necessary that the vmbilicall veine should be formed before the Liuer.

The opinion of some Anatomists.

This opinion is indeed very probable, and so sometimes seemed it to me (saith *Laurentius*) to be, but when I tooke a more serious consideration of the matter I found it to bee otherwise. For how should so many and so notable roots of veines as are dispersed through the whole *Parenchyma* of the Liuer, arise from so small a branch as this vmbilicall veyne is? Againe, those parts that arise one from another must of necessity bee continuated the one with the other. Now there is no continuity betweene the vmbilicall veine and the hollow veine, vnlesse it be by the inoculations of the rootes of the gate veine. What is more absurd then to thinke, first that the *Parenchyma* of the Liuer is made of the vmbilicall veine, & afterward that from that *Parenchyma* the rootes of all the veines should arise? Are not the spermaticall parts delineated before the fleshy? On the other side, who will say that all the Arteries are propagated from the vmbilicall arteries, seeing they reach not directly to the heart but to the *Iliack* branches? VVould we commend that builder who would set vp his wals before he lay his foundations? I know what wil be said, that these vessels are the roots by which the infant is nourished after the maner of a plant, now the roots are first formed. But they must know, that the infant is not nourished before his spermaticall parts be delineated, because before that time there is no necessity of Nutrition.

That the vmbilicall veine is not first formed.

We resolue therefore that these vessels are begun together with the rest of the spermaticall parts, and that the vmbilicall vein is a branch of the gate-veine to which it is continued; that the two vmbilicall Arteries are scions or shoots of the Iliack branches of the descending trunke of the great Artery; Finally, that the *Vrachos* ariseth from the bottome of the bladder and ascendeth vnto the Nauill. Yet we thinke that the vmbilicall Veine and Arteries are perfected before the rest of the vessels, because there was more neede of them for the coagmentation or gathering of the flesh, especially of the bowels.

What wee resolue of.

QVEST. XIX. *Of the times of the Conformation of a man and of a woman-childe.*

VVHich is the first and which is the last day of the Conformation of the Infant, God alone knoweth who made them; and if we haue any thing to say of this matter, we haue it out of *Hippocrates* Fountaines. His opinion is in his book *de Natura pueri* and *De Principijs*; That the seauenth day the rudiments of all the spermaticall parts do appeare, but the perfect dearticulation and description of the Female is in 42. daies, and of the Male in 30. at the longest. But this vvee thinke is to be vnderstood onely of the first Conformation; for we do not beleeue that the flesh of the Muscles is in that space perfected and accomplished, but the 3 or the 4. moneth rather, at what time the infant beginneth to moue: so that we make a double Conformation, one of the seede another of the blood; the first goeth before, which therefore *Hippocrates* in his booke *de Septimestri partu*, and *De Natura pueri* calleth πρώτην πῆξιν, the first coagulation or coagmentation; the secoud doth onely fill vp the distances of the first, that is, the spaces betweene the threds and fibres.

The time of Conformatiõ.

A double conformation.

Strabo the *Peripatetike*, and *Diocles Carystius* dispense the fabricke of the infant by seauens and seuens, alluding to that maiesty of the Septinary number which *Plato* conceiueth it to carry in it. Others thinke that 45 dayes is the vtmost limit of Conformation. For sixe dayes they ascribe *spumificationi*, to the frothing of it; foure *Lineationi* to the delineation, eight to the Repletion of the lines, fourteene *Carnificationi* to the generation of flesh: finally thirteene *Afformationi* to the accomplishment. The least time of this processe of Nature is thirty dayes, sixe for Spumification, two for Delineation, foure for Repletion or filling of the Lines, nine for Carnification, and as many for Afformation.

Strabo & Diocles.

Others thus in Verse.

Sex sunt in lacte dies, ter sunt in sanguine terni,
Bis seni Carnem, ter seni Membra figurant.

Sixe dayes it is in Milke, in blood three thrice accounted,
Twelue figurate the flesh, Members sixe thrice amounted.

Hippo-

Hippocrates. Why the male is sooner formed in the wombe.

Hippocrates much more diuinely and distinctly. Males are formed at the vttermost the 30. day, and Females the fortieth or the 42. Now the reason why a man childe is sooner formed in the wombe then a woman, and yet a woman out of the womb sooner commeth to perfection then a man, is indeed worth the search. This *Hippocrates* hath left vs in the second Section of his sixt Booke *Epidemion*. *Mas concreuit coaluitque citius, vbi motus est conquiescit & tardius augescit longioreque tempore. A Male gathereth sooner and is sooner articulated; after hee moueth hee stinteth his motion and groweth more slowly and in a longer time*; the same also he hath in the third Section of the third Booke *Epidemion*. That which moueth sooner and is sooner articulated is longer increasing in his growth The demonstration of the trueth of this is to be fetched also from *Hippocrates*: the Man-child is sooner formed in the wombe because he is hotter, for conformation is the worke of heate: and in the first Booke *de Diæta*, Males are generated of hotter seede, Females of colder. And in his Booke *de Natura pueri* in expresse words. *This is the reason why a Female is formed and articulated later then a Male, because the seede of the one is moyster and weaker then the seede of the other*. Adde hereto the nature and condition of the place, for Males for the most part are generated in the right side Females in the left, as appeareth in the 48. Aphorisme of the first Section; now the right side is hotter then the left.

Why the female is sooner perfected out of the wombe. *Aristotles* reason.

But why the Female out of the womb is sooner perfected, we must seek for a demonstration out of *Aristotle* in his Book *de ortu ad interitu*. The times of perfection and imperfection ought to be proportionably answerable one to another; corruption is an imperfection, but accretion and generation are accounted kinds of perfection; whatsoeuer sooner perisheth attayneth also sooner his perfection. So an acute and short disease runneth suddenly through all his foure times, and commeth sooner to his height or pitch then a chronicall or long disease. Now for the most part and generally women die sooner then men, as being of a shorter life because the principles of their life are weaker, and therefore they also doe sooner attayne the perfection of their life. To this wee may adde the softnesse of their bodies which makes them more apt for extension.

A double reason assigned by *Hippocrates*.

Hippocrates who was ignorant of nothing, in his Booke *de septimestri partu*, expresseth this briefly and plainly in these words. *After Females are separated from their mothers* (that is, are borne) *they cotten sooner then men, grow sooner wise and sooner old; as well because of the weaknes of their bodies as by reason of the maner of their life*. He therefore acknowledgeth a double cause; the first is weaknes, so that that which in the wombe was the cause of their slower conformation and motion, the same is the cause out of the woinbe of their more sudden & accelerated perfection. For a Female is a thing more imperfect then a Male and hath her end nearer then he, and therefore needeth not so long a worke of Nature. The other cause is the manner of their diet and course of life; for their life is idlie led in want of exercise.

Celsus.

Now slothfulnes sayeth *Celsus* dulleth the body, labour strengthneth it; the first maturateth or hastneth old age, the second prolongeth youth. Nether sayeth *Hippocrates* in his Book *de victus ratione in morbis acutis*, can a man enioy perfect health vnlesse he labour his body and take paynes, and in the fourth Section of the sixt Booke *Epidemion*. The best way to maintaine health, is to eate vnder satietie and to be free and diligent at labour.

Hippocrates.

QVEST. XX. *Whence it commeth that children are like their Parents.*

A threefold forme.

AS among Philosophers there is a three-fold forme of euery creature; the first *Specificall*; the second of the sexe; and the third of the *Indiuiduum* or particular by which it is that & no other thing: So among Phisitians there is a three-fold similitude. The first *in specie*, *i.* in the kinde; the second the sexe, the third in the fashion or feature or indiuiduall figure.

A threefold similitude.

What is the similitude of the species.

The similitude of the kinde they call that, when a creature of the same kinde is procreated, as a man of a man, a dog of a dogge: for euery thing worketh not vpon euery thing, neither doth euery thing suffer by euery thing; but euery agent worketh vpon his determinate patient; and therefore of the seede and bloud of a man onely a man is made. In this specificall similitude there is much attributed to the materiall cause, and that is the reason why the of-spring is vniuersally liker to the Female then to the Male, for the Female affordeth more matter to the generation then the Male, so of a shee Goat and a Ramme is generated a Kid not a Lambe, of a Sheep and a hee Goat a Lambe not a Kid.

What is the similitude of the sexe and whence.

The similitude of the sex (that is why a Male or Female is generated) hath for cause the

Temper

Temper of the ſeede, his mixture and victory. For if the ſeede of both Parents be very hot Males are generated, if very cold Females. If in the permixtion of the ſeedes the male ſeed haue the vpper hand a Male is procreated, if the Female ſeede a Female. This firſt of all *Hippocrates* taught in his firſt Booke *de diæta*, where he acknowledgeth in either ſexe a double ſeede, the one maſculine hotter and ſtronger, the other feminine that is colder, out of the diuers permixtion of which, both Males and Females are generated.

A threefold generation of Males out of *Hippocrates.*

He therefore thus diſtinguiſheth a threefold Generation of Males and Females. If both the Parents yeeld a maſculine ſeede they breede Male children of a noble and generous diſpoſition, λαμπρὸν τὰς ψυχὰς, καὶ τὸ σῶμα ἰσχυρόν, Nobly minded and ſtrong of body. If from the man there iſſue maſculine ſeede from the woman feminine and the maſculine preuaile a Male will be generated, but leſſe generous and ſtrong then the former. If from the woman there iſſue maſculine ſeed from the man feminine and the maſculine ouercome a Male wil be generated, but womaniſh, ſoft, baſe and effeminate. The very like may bee ſayed of the Generation of Females: For if from both the Parents doe iſſue feminine ſeede a Female will be procreated moſt weake and womaniſh. VVhich *Hippocrates* in the firſt Section of his ſixt Booke *Epidemion* calleth ὑδατώδεας, *aqueſcentes*, ſoft, wateriſh and looſe bodies. If from the woman proceede a feminine ſeede and from the man a maſculine and yet the feminine ouercome, women are begotten bold and moderate.

A threefold generation of Females.

If from the man proceede feminine ſeede and from the woman maſculine, and the womans ſeede preuaile, women are begotten, τολμηροτέρας καὶ ἀνδρείας, that is fierce and manniſh. The Temper therefore of the ſeede and the victory in the permixtion are the cauſes of the ſimilitude of the ſex, that is of Males and Females; which cauſes are alſo not a little aſſiſted by the Temper of the wombe and the condition of the place, for as I haue often ſaid Male children are borne in the right ſide, Females in the left.

The ſimilitude of the *indiuiduum.*

The third ſimilitude remayneth which conſiſteth altogether in the figure forme and accidents of the *indiuiduum*. This *Galen* in his ſecond Booke *de ſemine*, will haue to conſiſt in the differences of the partes and in the conformation of the members. By this, one is white another blacke, one hawke noſed another flat or ſaddle noſed. In this ſimilitude of the *Indiuiduum* conſiſteth all the difficulty of this queſtion, which we will mince as ſmall as we can that it may be diſgeſted without labour, from hence taking our beginning.

The Infant ſometimes is altogether like the mother, ſometimes altogether like the Father, other ſomtimes like them both, that is in ſome parts reſembling the mother in others the father. Oftentimes he reſembleth neither the father nor the mother, but the grandfather or the great grandfather; ſometimes he will be like an vnknowne friend, as for example an Æthiopian or ſuch like who neuer had hand in his generation. Of all theſe ſimilitudes we haue many examples in authours of approued credit.

Diuers examples of this ſimilitude.

The people called *Cammatæ* haue common wiues, and euery man chuſeth his childeren or refuſeth them as they are more or leſſe like vnto himſelfe. Among the *Chinians* the children are like their fathers in their noſe, their eyes, their forehead and their beard. There haue beene in certaine ſtockes and Tribes ſignes which they called *ſigna gentilitia*, that is, Stocke-markes, as to the *Spartanes* and *Thebanes* a Launce, ſome had a Starre, *Thyeſtes* a Crabbe, which were imprinted in their bodies from their birth; and theſe ſometimes were extinguiſhed in their children and grand children, but after a long time appeared againe in their poſteritiies.

Deleucus and his poſterity had in their thighes the faſhion and repreſentation of an Anchor. *Iulia* the daughter of *Auguſtus Cæſar*, although ſhe playd falſe and had many copeſmates, yet all her childeren were like her husband: Being asked what Art ſhe had for that conuayance, ſhe anſwered wittily and in ſome ſort honeſtly in reſpect of others of her profeſsion; *That ſhe neuer took in her paſſenger till her ſhip were fraughted.* I paſſe by what might be ſayd of the *Lentuli* and the *Macrocephali*: It will concerne vs more to ſpend our time in the ſearch after the cauſes of theſe things.

The firſt opinion of them that refer this likenes to the imagination.

The cauſe of this ſimilitude or likeneſſe of the forme and feature is very obſcure and full of controuerſie. *Empedocles* the *Pythagorean* referreth the cauſe of this likeneſſe only to the Imagination, whoſe force is ſo great that as it oftentimes changeth the body of the Imaginer: ſo alſo it transferreth his efficacy into the ſeed conceiued. The Arabians attributed ſo much to Imagination that they thought the Soule might ſo farre bee eleuated by imagination, that it ſhould not only worke vpon it own body, but alſo vpon an others: and that Soules ſo eleuated and enobled were able to change the Elements, to heale diſeaſes,

The *Arabians* opinion.

ſes, to weaken whom they liſted, to worke myracles, and finally to exerciſe a kind of command ouer all kinds of matter. *Ariſtotle* in the 12 Probleme of his tenth Section, acknowledgeth this power of the Imagination in the Conception and Infant conceiued. For he aſketh the queſtion why the off-ſpring of men are ſo vnlike one to another: and maketh aunſwere, becauſe in man the ſwiftneſſe of the cogitation and the variety of their wits did imprint many and diuers markes and ſeuerall impreſsions.

Ariſtotles

A Hiſtory out of Galen.

Galen in his Booke *de Theriaca ad Piſonem. I counſelled* (ſaith hee) *an Æthyopian that hee might beget a white and beautifull childe, to ſet at his beds feete a faire picture, vppon which his wife might wiſtly looke in the time of her conception. He obeyed my counſell and obtained his deſire.* And that was the reaſon why *Heſiodus* forbad women to haue company vvith theyr husbands when they returned from a Funerall, but when they came from bankets and diſport. For the illuſtration of this we haue a ſtory of a Sabine wife, of whome Sir *Thomas More* wrote an elegant verſe. And S. *Hierom* in his queſtions vpon Geneſis maketh mention of a woman who was ſuſpected for an Adultreſſe becauſe ſhe brought foorth a childe no way like her husband, but cleared her honeſty becauſe ſhee ſhewed a picture in her chamber like the childe ſhe brought forth. Thus *Iacob* in the 30. of *Geneſis* cunningly made the greateſt part of the flocke of a ſpotted fleece, by laying before the Ewes ſpotted rodds. *Pliny* in the 7. Booke of his Naturall Hiſtory remembreth many examples to this purpoſe, and *Fernelius* in the 7. Booke of his *Phyſiologia* conceiueth, that the Imagination onelie is the cauſe of this ſimilitude of the feature, by which alone hee thinketh the Facultie vvhich formeth the figure is led and gouerned.

S. *Ierom.*

Iacob.

Fernelius.

That it is not the imagination alone.

But me thinkes it is very harde to make the Imagination the onely cauſe of this Similitude. For, neither the Imagination nor any other faculty which hath knowledge ioyned thereto is able to work vnleſſe it haue his obiect preſent by which it may be mooued. Now we know that a childe often reſembleth one whom the mother neuer knew. Adde heereto, that in the coition all the Animall faculties are almoſt intercepted, ſo as the forming faculty can ſcarſe receiue or conceiue thoſe Imaginations.

Againe, if the Imagination alone were the cauſe of the ſimilitude then no infant ſhould be deformed, neither ſhould they be troubled with hereditary diſeaſes; for no mother wiſheth or imagineth euill to her owne children. The Aſtrologians referre the cauſe of the ſimilitude to the Starres. For (ſay they) as often as the Sunne is in the Center of the Horoſcope and the Conception is in the day time, ſo often are ſonnes begotten like their Fathers. And Daughters like their Mothers when the Moone is with the center of the Horoſcope if the conception be by night, or when *Venus* is with the Center of the Horoſcope if the conception be by day. But theſe are meere vanities.

The Aſtrologians.

Their opinió that referre it to the motion of the ſeede.

There are others who referre the cauſe of this likeneſſe onely to the motion of the ſeed and to the formatiue Faculty. And this is *Ariſtotles* opinion in his 4. Booke *De generatione Animalium*, and *Galen* in his 2. Booke *de Semine*.

Ariſtotles ſubtile Philoſophy.

Ariſtotles Philoſophy concerning this point is indeede very witty & excellent, but withall very obſcure. For he ſaith, that there are in the ſeede many Motions; ſome are Actuall, ſome Potentiall. The Actuall motions are either Vniuerſall or Particular: Vniuerſall, which generate a creature or a man; Particular, which generate males, & thoſe ſuch, that is, of ſuch a Forme, Magnitude of members, Lineaments & Habit. Thoſe motions which are Potentially in the ſeede do proceede from the Grandfather, great Grandfather and the Mother. If one of theſe motions, to wit, that which is neareſt and moſt Particular bee intercepted, then is tranſition made into the next motion, and if that be Deficient, tranſition is made into the Contrary; and at length into the Vniuerſal. Theſe diſtinctions of Motions which I doubt not ſeeme vnto you confuſed and entangled we will make more manifeſt by an example.

Made plaine by an inſtance

In the ſeede of *Socrates*, there is a power to beget a male childe like vnto himſelfe. The ſeede therefore is mooued toward the forme of *Socrates*. This Motion, if it bee hindred eyther by the ſeede of his wife which happely is ſtronger then his, or by the coldneſſe of the wombe, or by any other cauſe; then is that firſt motion of the father diſſolued & loſt which was actually in *Socrates*, and tranſition is made into the motion of the Grandfather or great Grandfather which was not in the ſeed of *Socrates* Actually but Potentially, & ſo the child becommeth like *Socrates* Father or his Grandfather; if this ſecond motion be interrupted then is tranſition made into a Contrary motion, that is, into the motion of the ſeed of the Mother, which *Ariſtotle* calleth Contrary, becauſe Nature at the firſt hand and of her ſelf

euer

euer intendeth the Generation of a Male. Whereforei,n the ſteade of a Male ſhall then a Female be procreated like vnto the mother or the grandmother or great grandmother, whoſe *effigies* or repreſentation the ſeede of the woman potentially contayneth. This third motion if it be intercepted, finally there is tranſition into an vniuerſall motion, and a man ſhall be borne indeed, but like neither father nor mother.

Galens opinion.

Galen in his ſecond Booke *de ſemine* doeth not acknowledge theſe ſo diuers motions of the ſeede, but referreth the cauſes of the ſimilitude to the temper of the ſeed, and the diuers permixtions thereof, as alſo to the ſtrength of the formatiue faculty. That learned man *Eraſtus* referreth the cauſe of this indiuidual ſimilitude onely to the formatiue faculty, quite excluding the power of the Imaginatiõ, becauſe he perceiued that blind creatures brought forth young like vnto their ſires. The formatiue faculty ſayth he hath no need of a pattern: for as in the ſeede of Lettuce that faculty being therein, generateth and formeth a Lettuce without a patterne; ſo in the ſeede of a man, the formatiue faculty accompliſheth his work without any pattern or imagination at all. But what will *Eraſtus* ſay to that white woman who attentiuely fixing her eyes vpon the picture of an Æthiopian brought foorth a blacke childe? what to her that brought forth a hayrie child by looking often vpon the picture of S. Iohn Baptiſt cloathed in Cammels haire?

Eraſtus opinion.

What our reſolution is

VVee, that through the waues of this turbulent ſea of opinions wee may ariue in a ſafe harbour, will acknowledge a double cauſe of this diuers ſimilitude, which is in the feature forme and accidents of the *Indiuiduum* or particular creature. The one ordinarie which alwayes worketh vnleſſe it be interrupted, and this is the formatiue faculty ingenite with the ſeede: the other extraordinary which doth not alwaies concurre to generation, but commeth from without & is more noble then the former, becauſe it hath power ouer it now and then and ſetteth a new ſeale vppon the tender and ſoft nature of the childe, and this we call Imagination or Cogitation.

What the formatiue faculty can do.

That firſt forming faculty becauſe it conteyneth in it ſelfe the *Idea* of all the particular parts if it worke freely and at liberty and be not interrupted by any thing in the whole time of the conformation as it hapneth in other creatures and in plants, it euer more ſetteth that ſtamp vpon the Infant which is in the ſeed it ſelfe, and ſo the children become alwaies like vnto their Parents; wholly to the father if the fathers ſeede doe alwayes and totally ouercome, and altogether to the mother if the mothers ſeede haue the victory: In ſome parts to the father, in others to the mother if any part of the ſeed of either be ouercome by the other. For though the ſeede appeare to the view *homogenie* yet hath it ſome partes more thicke others thinner.

How children become like their progenitors.

Sometimes the children repreſente the grandfather or great grandfather, becauſe there lurkes yet in the fathers ſeed ſome faculty deriued from them. For *Ariſtotles* opinion is that the *ſpecies* or forme of the parents may be extended to the 4. generation: & euen as a Loadſtone ſhooteth forth his force and efficacie through the needles hanging one at the end of another to the fourth or beyond; ſo that formatiue faculty is tranſmitted from one ſeed to another. So *Helis* who accompanied with an Æthiopian did not bring foorth a blacke daughter, but yet that daughter of hers brought forth a blacke ſonne. And *Nicæus* the Poet of Conſtantinople though begotten of white Parents, did degenerate into the colour of his grandfather who was an Æthiopian.

Hiſtories.

If therefore the formatiue faculty work at liberty it will alwayes generate children like the Parents; but if in the beginning of the conformation the formatiue faculty be hindred by another which is more powerfull and diuine then it ſelfe, ſuch as is the Imagination, then will the impreſsion follow not the weaker but the ſtronger, and ſo the Infant will become vnlike the Parents. For the Imagination commandeth the forming faculty, becauſe the formatiue faculty is but a production of the procreating power which is Naturall; but the Imagination is a Principall faculty: now what Imagination can doe as well in the conformation as after it we haue touched already, to which we will adde theſe things to make vp the queſtion with.

What the Imagination can do in this ſimilitude.

Why and how the impreſſion is made vpon the infant.

Oftentimes the Imagination of that thing is imprinted in the tender Infant which the mother with childe doth ardently deſire, which is onely to bee imputed to the ſtrength of the fancy. For the reall *ſpecies* of a Figge or a Mulbery is not tranſported to the wombe, but onely the ſpirituall forme or abſtracted notion, which is ſooner faſtned vppon the Infant then vpon the wombe, becauſe an impreſsion is ſooner made in ſoft waxe then in hard yron.

Fur-

Answere out of *Auicen.*

Furthermore, the manner of this impression *Auicen* hath expressed in his first Booke *De Animalibus*, where he saith, That a strong Imagination doth instantly mooue aery spirites which are mooueable of their owne Nature, and in these it setteth the stampe of the thing desired; the spirits being mingled with the blood which is the immediate Aliment of the Infant, do imprint in it the same figure they receyued from the Imagination. But howe the spirits should so suddenly receiue and apprehend the *spectra* or Images represented by the imagination, belongeth to a higher contemplation. Our opinion is, that as the forming faculty in the heauens of those creatures whose generation is equinocall, is imprinted in the aer; after the same maner the formes of the Imagination are insculped or engrauen in the aery spirites. As therefore the aer is full of formes (as wee shall shew more at large when we come to the Nature of the sight) so our spirits which are aery doe easily admit all species or formes of things. So the seede by reason of the spirits which wander and gad vp and downe through all the parts of the body dooth containe in it selfe, as wee haue shewed already, the Idea and images of all the particular parts.

How the spirits receyue the impression of the imagination.

QVEST. XXI. *How Twinnes, or more Infants are generated.*

Why man engendreth not so many yong as bruit beasts

THe Immortall God of his Diuine prouidence hath giuen almost to all brute creatures a power to bring foorth many young at once least their kindes should be extinguished, for that of themselues they are but short liued & beside serue man for food & raiment, yea prey also one vpon another. Man the most temperate and of longest continuance, by the prescript of Nature breedeth but one infant at once, or at the most but two; because there is but one bosom in the wombe of a woman; but two parts thereof the right and the left distinguished only by a line, not disseuered by any partition; and onely two dugges appointed to nourish two infants which we call Twinnes. And if at any time a Woman bring foorth three or more that seemeth to the Philosophers to be παρὰ φύσιν, vnnaturall.

Histories of manifolde infants at a birth

Wee haue many Elegant Histories of such manifolde burthens. In Egypt where *Nylus* that fruitfull Riuer runnes, women bring sometimes six at a birth. *Aristotle* in his seuenth Booke *De Historia animalium* affirmeth that one Woman at foure birthes brought into the world twenty al perfect. *Tragus* reporteth, that in Egypt it hath been known that a vvoman hath borne seauen infants at once. *Albertus* telleth a tale of a woman in *Germany* who hauing two and twenty infants formed in hir wombe suffered abortment, and of another who had at once 150. all of them being as bigge as a mans little finger.

Margaret Countesse of *Holland*, is saide to haue brought foorth at one burthen 364 liuing infants, who were all christned but dyed presently after, the Males were named *Iohn*, and the Females *Elizabeth*: there remaineth to this day a stately Marble Sepulchre of hirs in a Monastery in *Holland*. Ther are also many other Histories of such like burthens as these which I willingly pretermit, being more willing to spend my time in searching out the causes of them.

The cause of Twinnes.

Many of the Ancients referre the cause of Twinnes and manifolde burthens to the variety of the bosomes of the wombe, for they make seauen bosomes in the wombe of a Woman, which they call κόλπους or Cels; three in the right side of the VVombe appointed for male children, and three in the left appointed for females, the seuenth in the midst wherin Hermophradytes are engendred, but these are idle conceites, next a Kinne to Olde wiues tales. For in a womans wombe there is but one bosom, as there is but one cauity in the stomacke which yet may be diuided into the right side and the left. These sides are disseuered by no partition, whatsoeuer *Auicenna Haliabbas* & many other Anatomists do auouch, as they are in sheepe, but onely distinguished by a line, which *Aristotle* calleth διχρόα, that is, A middle Line, which word he tooke out of *Hippocrates* in his *Coacæ Prænotiones*. Moreouer that the variety of Celles cannot be the cause of the multiplicity of the burthen that among other things may bee an argument, because sometime twenty young ones or more may at once bee conceiued, but no man I thinke will say there are so many bosomes in the womb; neither yet in other creatures are there so many bosomes as there are yong, as appeareth in Fishes who haue an infinit number of spawn yet no partition or distinction between them. *Erasistratus* referreth the cause of Twins to a repetition of conception. *Empedocles* vnto the plenty of seede, *Ptolomy* to the diuerse positions of the Starres.

Is not the variety of Cels.

But one bosome in a womans wombe

The true cause *Hippocrates* acknowledgeth in his first Booke *de Diæta*, to be the Diuision of the seede. *So it was necessarie that the Seede be diuided equally into both sides of the wombe.*

For

For oftentimes in coition all the seede is not at once ciaculated but by fittes or turnes; so sayeth our Maister: neither doth the seed alwayes issue at once, but it boyleth and is ciaculated at twice or thrice. A part therefore of the seed falleth into one side of the womb, and another part into another, and so Twins are conceiued.

Asclepiades referreth the cause of Twinnes to the excellency of the seede, which if it bee strong is able to make many Infants. *Auicen* addeth as another cause the motion of the wombe, which draweth vnto it selfe the seede of a man and disposeth it diuersly, bestowing the parts of the seede in this side and that side of the wombe from whence comes a multiplicity of Conceptions. And these are all the causes of Twinnes or many Infants. But that their Conception and Conformation may the better bee manifest, wee are to discusse three questions. The first whether at the same coition a Male and a Female may bee procreated. Secondly, whether Twinnes are included within the same membranes, and conteyned in diuerse places. Lastly, why Twinnes are commonly so like one another, and all these we will resolue out of *Hippocrates*. For the first, wee say that at once two Males, two Females, a Male and a Female may be conceiued at one and the same coition. The manner is thus expressed by *Hippocrates* in his first Booke *de dieta*, and in his Booke *de Natura pueri*: If from both Parents masculine seed doe issue then are two Males generated, if feminine seede two Females, if both masculine and feminine, then of the masculine is a Male conceiued, and a Female of the feminine.

Asclepiades opinion.

Auicens opinion.

Whether in one coition a male and a female may bee conceiued.

Moreouer Twinnes that are both Males or both Females do for the most part suruiue, but if they prooue a male and a female, the female doeth scarce suruiue or at least is very weake, because it is not formed and perfected at the same time wherein the Male is formed and perfected. This *Aristotle* expresseth very plainly in the sixt Chapter of his fourth book *de Generatione Animalium*. If the Twins be a male and a female they rarely suruiue, because this duplication in men is vnnatural, for that the male & the female are not distinguished in the same time, vnlesse the males conformation bee foreslowed, or the females ouerhastned.

The second question *Hippocrates* answereth in his Booke *de Superfœtatione*: The woman sayeth he, that is with childe with Twinnes, trauelleth of them both in one day, and if they be both of one sex they are conteyned in one after-birth. Wherefore the Twinnes of the same sexe are wrapped in the same membranes, yet each of them haue their particular vmbilicall vesselles: but if they bee of diuers sexes they haue their diuers coates. Againe, if they be both of one sexe they are carried in the same side of the wombe, two boyes in the right side, and two wenches in the left; but if they bee of different sexes, the male shall bee concluded in the right side of the wombe, and the female in the left.

The third question was why Twinnes are so very like one another. *Hippocrates* in his first Booke *de diæta* acknowledgeth a threefould cause of this similitude. First of all sayeth he the places wherein they receiue their augmentation are equall, whether they be conceiued in the right or in the left side of the wombe, because by a wonderful prouidence of nature, the right are equall to the left, that so the whole body might be ἰσόῤῥοπον, that is, equally ballanced. Againe, because they are conceiued together; lastly because they vse the same Aliments, for they sucke the same bloud and enioy the same vitall spirites which they draw from their mother by the vmbilicall arteries. And thus much of Twinnes, now wee proceed to *Superfœtation*.

QVEST. XXII. *How Superfœtation is made, why onely a woman when she hath conceiued desireth the company of the Male, and by what wayes she then ciaculateth Seed.*

THere are so many difficulties concerning the nature and manner of superfœtation that many men haue imagined there can be no such thing, but we must not giue eare vnto them. For *Hippocrates* wrote a booke *De superfœtatione*, & there is a notable example of *superfœtation* in his first booke *Epidem*: in a woman of *Larissa*, who the fortieth day after her deliuerance of a legittimate childe auoyded another preposterously conceiued. Famous also is that birth of *Alcmæna*, when she brought forth *Hercules* and *Iphiclus* his brother after him. *Aristotle* in the fifth chapter of his fourth Booke *De generatione Animalium* saith, that some creatures admit *superfœtation*, others do not admit it: and of these that do, some are able to nourish both burthens, some are not able sometimes, at other times they are able. And in his Booke *De Historia Animalium*, he alledgeth some examples of *superfœtation*. A certaine adultresse,

Diuers examples of *superfœtation*.

saith he, brought forth one infant like her husband, another like the adulterer: another being with child with twins had a third by *Superfætation*. Another brought forth one the seuenth moneth which died, and in the ninth was deliuered of two others which did surviue. *Galen* makes mention of *superfætation* but seldome. *Rhazis* 22. *Continent*, *Alzarauius* and *Auicen* are all of opinion, that those women are subiect to *superfætatation* who whilest they are with childe haue their courses. *Plinie* in the eleuenth chapter of his 7. Booke writeth, that *Proconnesia* a seruant accompanied the same day with her maister & his man, and conceiued by them both, and bare either of them a sonne like to the father. That another was deliuered of a childe at fiue moneths and went out her iust time with a second: that another was deliuered of a child at seuen moneths and went out her whole time with two twins beside. *Dodoneus* in his obseruations telleth stories to the same purpose. Wee conclude therefore that there may be *superfætation*. Now this *superfætation* is nothing else but a second conception, when a woman already with child accompanying with a man conceiueth againe, as if it were a new conception aboue another before conceiued. This *superfætation* or iterated conception is not common to all creatures, as *Aristotle* teacheth in his fourth Booke *De generatione Animalium*, to women it happeneth oftener then to others creatures, vnlesse it be Hares and Swine; notwithstanding whensoeuer it happeneth, it is beside the ordinary course of nature. Now the reason why *superfætation* happeneth most in women, is because women, and they almost only, after their conception do desire the company of their husbands. Other creatures when they are pagled as we say, do neuer or very seldome admit the Male, but what may be reason hereof? *Dinus* in his Comentaries vppon *Hippocrates* booke *de natura pueri* saith, that other creatures after they haue conceiued, doe not desire the company of the Male, because all that which should bee the matter of new seede is consumed in the nourishment of their young, and therefore they are not goaded with their wonted lust. But a woman, because she hath in her aboundance of moysture, hath also her vessels full of seede, from whence comes the motion and sense of the obscoene parts. But this reason I cannot approue. For although the infant do consume almost all the reliques or surplusage of the blood, yet doth it not defraude the parts of the mothers body of their conuenient nourishment; neither taketh from the Testicles their proper faculty of drawing and altering the blood. So women at sixtie years old haue no surplusage of blood and therefore their courses faile; yet they continue to procreate seede euen to their extreme age, which also in coition they auoyde, which though at that age it be not fit for generation, yet is it sufficient to prouoke pleasure.

What superfœtation is.

Why superfœtation belongeth most to women. *Dinus.*

Disproued.

VVe acknowledge other causes of this disposition of women and those naturall. For the Morall causes of which *Lactantius* writeth in his book *de vero cultu* we leaue to diuines. The first is, the scituation and conformation of the wombe: for in other creatures when they are great with yong the wombe is nearer the outward parts, and therefore more in danger to be violated by the Male whose genitals are of a great length, and for the most part of a harder substance. But a womans womb is scituated further inward and beyond the mans reach and therefore she beareth him the more easilier. Again, to beasts the vse of *Venus* is onely giuen for the preseruation of their kinde; if therefore they conceiue the finall cause being satisfied their desire of coition is also appeased; but man vseth these pleasures not onely to propagate his kind, but also to sweeten and mittigate the tedious and irksome labors and cares of his life. *Poppea* the daughter of *Agrippa* being asked this question why beasts did not copulate after they had conceiued, her answer was, *because they were beastes*; and truely the answere beside the quickness of it was not amisse; for it is a prerogatiue which Nature hath giuen to man aboue other creatures: but to returne to our question. It appeareth therefore that the reason why *superfætation* is more ordinary in women then in all other creatures is, because when shee hath conceiued yet shee may desire the society of the Male. Now let vs enquire how this *superfætation* may be.

The true causes thereof. First.

Second.

Poppea her acute answere.

How superfœtation is.

Most certaine it is that the wombe is so greedy of seede, that after Conception it is so contracted that there is no void space left in it, and the inward orifice so close shut that nothing can passe into it or issue out of it. This *Galen* teacheth vs in many places, and *Hippocrates* in the 51. Aphorisme of the 5. Section. *Those that are with child haue the mouth of their wombes closed.* How therefore can it be that the seede of the Male can ariue into the bosome of the wombe to make a second Conception? There haue beene some of the Antients who dreamt that by a wonderfull prouidence of Nature, the womb at certaine times did open it selfe to auoyde those things which might otherwise offend it; at which times if

Hippocrates.

The opinion of some.

a woman with childshould accompany with a man, the wombe might entertaine his seed, and so breede a Superfœtation. But I take these to be but idle and addle imaginations. For if through the whole course of those nine months the wombe should at certaine times open it self to expell that that is superuacuous: why then are the *Lochia* (i, those purgations which issue after trauel) reteined all the time in the womb? Or can the womb at the same time that it auoideth that wherewith it is offended, receiue also the seede whereby it is pleased and conceiue the same? Rather the seed would so be extinguished. Confuted.

Among the late writers there are some who thinke that the wombe is neuer so exquisitly shut, but that it may admit seede; which their opinion they establish by these Reasons. When women are with child they often auoide their Courses pallid, Flegmatick or black, which out of question lay lurking in the cauity of the VVombe, and therefore the Orifice thereof is not so perfectly shut. Another opinion of the new writers. Reason. 1.

Againe, a woman with childe in coition looseth seede, which she perceyueth to yssue from her by her lap, which way it could not yssue vnlesse it came thorough the necke from the cauity of the wombe, because a woman eiaculateth her seede by the sides into the bottome of her wombe. The orifice therefore of the wombe is alwayes open and so hapneth superfœtation the more easily. With these arguments they think they haue won the cause, whereas for want of skill in Anatomy they cast a mist ouer *Hippocrates* Sunshine. For that I may answer their first argument. It is manifest by this maner of reasoning that they are ignorant, that there are two veines which disperse their branches through the wombe, some of which are carried to the inward cauity thereof by which the infant is nourished, others run to the outward part of the wombe euen vnto the necke and the lap it selfe. Disproued. The first reason satisfied.

By these all the time of their ingrauidation or in which they go with childe, the bloode yssueth and the superfluities of the body are purged without interruption, although the inward orifice of the wombe be neuer so closely shut. Their latter reason would vrge more but that we finde two passages whereby the womans seede is auoyded. The first passage determineth in the hornes or sides of the wombe by which the seede is eiaculated into the bosome of the wombe when a woman is not with childe, for it is the shorter and the opener way. The other passage was vnknown to the Ancients and to many also of the later Anatomists, but easie to be obserued in Dissection if it be diligently sort for. It ioyneth vvith the former but is longer, and runneth along the sides of the wombe and the necke and endeth in the lap. By this passage we beleeue that women with childe do auoide their seede, and therefore do conceyue greater pleasure in their husbands companies, because the Seede runneth a longer course through the vessels and beside through the Membranous neck of the wombe, both which are of exquisite sense. The second reason answered. Two passages of seede.

The manner of Superfœration *Hippocrates* first of all opened in his Booke *de Superfœtatione*, where hee saith; *Superfœtation hapneth to those women, the mouth of whose wombe after their first Conception is not close shut.* For if at that time a woman do againe accompanie with her husband, she will easily receyue his seede and lay it vp in the bosom of the womb, from whence commeth a second Conception. Now this must be vnderstood of the thirde or fourth day after the first conception, for the wombe cannot abide open all the time of Conformation. The manner of superfœtation out of *Hippocrates*.

But a Question may be asked whither Superfœtation may happen after the first, second, or third month of the first conception, as many men do write and alledge manie examples therefore? We answere, we thinke it may so happen but very rarely. For the wombe may be so enraged, that it may open againe and receiue new seede, and yet the former conception not be violated if the woman be sound and the infant strong, as well because it is firmly tied to the wombe by the mouths of the vessells, as also because as yet it seeketh not to bee enlarged. Whether superfœtation may be after two or three moneths. Answere.

This we, sayth *Laurentius*, haue sometimes obserued in Twinnes. I saw (sayth he) a Noble Woman conceyued of two Twinnes, who first was deliuered the first day of the ninth Month of a dead child, and the seauenth day after of another aliue. Histories.

The like Historie there is in *Hippocrates* seauenth Booke of his *Epidemia*, vvhose wordes are these: *Terpida a Woman of Dorisceus* (a Citie of Thracia) *vvhen shee had gone vvith Twinnes fiue Monethes, by some mischaunce suffered Abortment, the one yssued foorth presentlie compassed with a Membrane, the other shee vvent vvith about fortie dayes after.* The inwarde Orifice of the VVombe may therefore bee opened, and yet the Terpida.

the infant remayneth behinde. Wee haue alſo for this the authority of *Hippocrates* in the the 38 Aphoriſme of the fift Section, where he ſaith, *A Woman with childe with Twinnes, if either pappe fall and grow looſe, ſhe wil abort of one of her children, if it be the right breaſt of a Male, if it be the left breſt of a Female.* The Infant therefore may be reteined in the Wombe although the Orifice of the wombe open euen to an abortment. And although the ſecond conception happen the third or the fourth month, yet is it not neceſſary that the firſt ſhold miſcarry; & yet the ſecond conceptions do ſeldom thriue and ſuruiue, eſpecially if they be long after the firſt, becauſe the former infant beeing great draweth away moſt part of the blood, whence it commeth to paſſe that the younger Brother is defrauded of his nouriſhment, and ſo periſheth and is moſt what auoyded before his due time. And ſo much of Superfœtation. Now it is time that we proceede vnto the Controuerſies concerning the noriſhment & augmentation of the Infant.

Hippocrates authority.

Second Conceptions rarely thriue

QVEST. XXIII. *Whether the Infant drawe his Nouriſhment at his mouth.*

OVr whole diſputation concerning the Nouriſhment of the Infant we will abſolue in three queſtions. In the firſt we wil diſpute by what wayes he draweth his Aliment. In the ſecond, what kinde of Nouriſhment he draweth. In the third, how that Nouriſhment is changed and whether it paſſe all three concoctions.

Which way the Infant drawes Nouriſhment.

For the firſt. *Alcmæon* thought that the Infant drewe his nouriſhment by his whole bodo, becauſe it is rare and ſpongy; and as a Sponge ſucketh vp water on euery ſide, ſo thoght he the infant ſucketh blood not onely from his Mothers veines, but alſo from the ſubſtance of her wombe. *Democritus* and *Epicurus* thought, as *Plutarke* reporteth in his fift Booke *de placitis Philoſophorum*, that the Infant in the wombe drew his nouriſhment at his mouth, which thing alſo *Hippocrates* ſeemeth to confeſſe in his Booke *de Principijs*, *The Childe in the womb gathering his lips togither, ſucketh out of his Mothers wombe and draweth both Aliment and ſpirit to his heart when the Mother breatheth.*

Alcmæons opinion.

Democritus & Epicurus.

Hippocrates corrupted.

This opinion hee confirmeth with a double reaſon. Firſt, becauſe children when they are borne haue excrements in their guttes. Secondly, becauſe as ſoone as they are borne they ſucke Milke with their mouths, becauſe they were accuſtomed to ſucke in the womb. *Hippocrates* verily was ſo diuine a writer, that in all that he ſayth we are bound to reuerence him and giue good heede vnto him. And therefore heerein wee are either to excuſe him, becauſe in thoſe times the skill of Anatomy was but in the infancy; or elſe wee may thinke that this, as many other things, was foiſted into his workes. For, in his Golden Booke *De Nutritione* he maketh knowne vnto vs the wayes of this noriſhment of the infant in this oracle. *The firſt Aliment is through the Abdomen by the Nauel.* As if he ſhould ſay; the firſt Aliment is drawne by the Nauell, becauſe it is ſcituated in the middeſt of the *Abdomen*. For how ſhould he draw it by his mouth ſeeing there are no veſſels deriued thither? Neyther hath the infant any coniunction with the womb of the Mother vnleſſe it be by the mouths of their veſſels meeting together, all which veſſels do determine into the Nauell. Moreouer in his Booke *de Natura pueri* he writeth in plaine wordes, that the infant draweth both his nouriſhment and his ſpirit or breath by the Nauell. *In the middle of the fleſh is the Nauel ſeparated, by which the infant breatheth and getteth his encreaſe.* And in his Book *de Octimeſtri partu. The Nauel by which the way is for the aer and the Aliment to ſuſtaine the infant, and the onely ingreſſe by which he cleaueth to his Mother. And by this way is the infant made partaker of thoſe things that enter into the body.* And againe in his Booke *de Natura pueri. The Midwife as ſoone as the Infant is borne tyeth his Nauel, as beeing no more neceſſary to nouriſh him by; and withall ſhe openeth his Mouth to ſhew him another way by which hee ſhould receyue his nouriſhment.*

Hippo. excuſed

His own opinion in manie places.

Seeing therfore *Hippocrates* in all theſe places teacheth vs that the Infant draweth his Nouriſhment and aer alſo by the Nauell not by his mouth; wee conclude that the place aboue vrged is ſurreptitious. For the reaſons which he is made in that place to giue are not beſeeming the learning of ſo great a man, neither anſwerable as you ſee to his opinion in other Tractates which are legittimate and paſt exception, as which indeede none but the diuine wit of *Hippocrates* could endite. Neyther therefore doth the infant ſucke Milke after he is borne becauſe he was accuſtomed to ſucke in the wombe, but becauſe hee is ſo taught by vntaught Nature; the ſame hath *Hippo.* in the ſixt Booke of his *Epidemia*, *Nature not taught doth*

Why the Infant ſucketh as ſoone as he is borne.

doth yet that rightly whith ſhee hath not learned; and in his Booke περὶ τροφῆς *de Nutritione*, *Nature is taught of none.* The Infant therefore inſtantly ſucketh, not from cuſtome but by Nature or by wil, which is by inſtinct: for after he is grown old he wil ſuck again if he think it fit ſo to do, becauſe, as that moſt ſubtile *Scaliger* ſayeth in his 239. Exerciſe, There is but one faculty which ſerueth the Soule for the behooſe of the body, which alſo hath therewithall adioyned a notion of his owne conſeruation. *Scaliger.*

As for thoſe excrements which the Infant auoydeth by ſiedge as ſoone as it is borne, they are not excrements of the firſt concoction or of Chylification, and therefore cannot properly bee called *fæces* and *ſtercora*; but recrements of the more impure and thicker blood, which are conuayed by the Spleenicke and meſentericall branches from the ſpleen to the Guttes, and there by long ſtay and heate doe grow drye and exiccated. VVherefore wee conclude that the Infant draweth not his nouriſhment by his mouth but by the Nauell. What it is the Infant auoydeth downward.

QVEST. XXIIII. *Whether the Infant be nouriſhed onely with bloud, and whether he accompliſh onely one Concoction.*

COncerning the Nature and kinde of Aliment wherewith the tender *Embryo* is nouriſhed ſo long as hee is contayned within the mothers wombe, there is no light Controuerſie. *Hippocrates* thought that he was nouriſhed with the pureſt part of his mothers blood. To this purpoſe there is an elegant place in his firſt Booke *de morbis mulierum*. *A woman with child* (ſaith he) *is all ouer of a greeniſh pallid colour, becauſe her pure bloud is dayly drawne from her, and deſcendeth to the nouriſhment of the Infant.* *Galen* in his firſt Booke *de cauſis ſymptomatum* and the 7. Chapter faith that the ſmall and tender Infant drawes in the firſt moneths the pureſt of the blood, but when he is growne greater, he draweth the pure and impure together. That the Infant is nouriſhed with pure bloud.

Hippocrates in his Booke *de Natura pueri*, wrote many things but very obſcurely, concerning the Aliment of the Infant: for he acknowledgeth a double Aliment, Bloud & Milke. In the firſt moneths he thinkes the Infant is nouriſhed with pure bloud: but *when he beginneth to moue, that then a part of the bloud returneth to the Pappes, and is there turned into Milk, and from thence commeth againe to the wombe by the communion of the veines for the nouriſhment of the Infant*; as if the bloud were circularly conuayed from, and to the wombe againe as *Chymiſts* vſe to do in their deſtillations. But I ſee not either why, or how the Infãt ſhould be nouriſhed with Milke, ſeeing al his Aliment is carried firſt by the veines vnto the Liuer: Vnleſſe we ſhall ſay that the Infant growne great is nouriſhed with Milk, that is with bloud contayned in the veines of the Pappes, which commeth neare to the Nature of Milk. For when the bloud is exhauſted or drawn out of the firſt veines, he draweth bloud from other veines, eſpecially from ſuch as are more common and ample or large. Now the ſociety of the veines of the wombe and the Paps is admirable. Here ſome man may aske how the Infant can draw pure bloud ſeeing it hath much whey mingled therewith, which is prooued by the collection of the vrine? I anſwere that the naturall whey doeth not take away the puritie of the blood, yea if it wanted his whey it were not pure but altogether faulty: and *Hippocrates* alwayes diſalloweth of that bloud which is εἰλικρινὲς that is, ſincere and vnmixt. Whether the Infant in the wombe be nouriſhed with milke. *Hippocrates* expounded. Obiection. Solution.

The third thing to be enquired off remaineth, that is, how the Aliment of the Infant is changed and altered, whether it paſſe through the three concoctions, or but two, or onely one? Some Imagine that the blood is conueyed by the vmbilicall veine to the branches of the gate veine, from theſe vnto the ſtomacke where it is conuerted into a ſubſtance like vnto Creame, and thence by the branches of the meſentery tranſported to the Liuer, and by it turned into blood, and ſo is made by Chylification and Sanguification in the Infant. For blood if it be taken at the mouth and ſwallowed into the ſtomacke, putteth of his forme of blood, and acquireth a new forme of Creame. For my ſelfe if I may ſpeake as I thinke, I conceiue that there is but one concoction in the Infant; for what neede is there of Chylification or of a new Sanguification, ſeeing he draweth the pureſt of his mothers blood? I confeſſe that it is perfected and further boyled as well in the greater as in the leſſer veſſels, that ſo there may be the greater ſimilitude betweene the Infant and his nouriſhment; but that it ſhould acquire a new forme, that will not ſinke into my minde; for the bloud remaineth bloud and hath the ſame power of nouriſhing it had before, onely it differeth in perfection and in ſome accidents. How many concoctions are in the Infant.

As for Chylification that was not neceſſary in the Infant, becauſe the excrement of Chylification which is thicke and fœculent or euill ſauoured would with the waight and burthen be troubleſome to him, ſeeing hee hath no membranes allotted for the receiuing or contayning them. Heereto you may alſo adde the noyſome ſmell of the excrements, which doubtleſſe would be offenſiue both to the Infant and to his mother. VVe conclude therfore that in the Infant there is no other but onely the third concoction.

That there is onely the third concoction.

QVEST. XXV. *Of the Communion of the foure Veſſels of the Heart in the Infant.*

The firſt Exerciſe, wherein the trueth of Galens demonſtration is illuſtrated.

THat wonderfull Communion of the veſſelles of the Heart which is found in the Infant, to wit, of the hollow Vein with the venall Artery, and of the great Artery with the arteriall Veine, *Galen* firſt of all men hath ſo excellently deſcribed in his ſixt and fifteenth Bookes of the vſe of Partes, that there is nothing in that whole worke more playnly, more clearely, nor more diuinely handled: but in the vſe of theſe Anaſtamoſes hee hath not ſo ſufficiently explayned himſelfe. For in the 15. Booke hee thinketh that both thoſe inoculations were framed onely for the Lungs ſake; but in the 6. Book he writeth that they are ſome helpe vnto the Heart for the performance of the offices of the vitall faculty. VVherefore becauſe in diuers places he ſpeaketh of diuers vſes of thē, although both places may well ſtand togither, yet thence haue all thoſe taken occaſion to carp at him who either from a ſpirit of contradiction, or from an ambitious deſire to gayne-ſay great men, or from a kinde of wantonneſſe of witte doe forſake the authenticke learning of the Antients and ſeeke for a new kinde of Philoſophy in the greene, raw and vnripe fruits of the later writers.

Galen firſt deſcribed this communion.

But varieth in the vſes therof.

It is not good indeed to pin a mans knowledge vpon any particular mans ſleeue, neyther doe I thinke it the part of a true Philoſopher to ſweare that another man hath ſayed, were it *Hippocrates* himſelfe: but yet wherein the Antients haue gone before vs in ſtrength of demonſtration and euidence of trueth, there to ſtart aſide after the nouel and vndigeſted inuentions of greene wits, I hould it may be a ſigne of a ripe wit, but not of ſound and eſtabliſhed wiſedome or iudgement. VVherefore I will endeuour in this place to ſhew you *Galens* curious, elegant and acurate demonſtration of the Communion of theſe veſſelles; afterward we will enquire alſo what other men haue ſaid of it.

How far we are to ſticke to the antients.

Galen therefore in his fifteenth Booke *de vſu partium* and the ſixt Chapter, asketh the queſtion, why the Lungs in the Infant are redde and not whitiſh as they are after a man is borne. He anſwereth, becauſe they are nouriſhed with thicke and red bloud brought vnto them by veſſels hauing but a ſingle coat, that is by Veines. But there are no paſſages from the hollow Veine into the Lungs; and therefore it was of neceſsity that that hollowe Vein ſhould haue a paſſage bored into the venal Artery. This therefore is the firſt and primary vſe of this hole or perforation.

Galens elegāt demonſtration of this communion.

The vſe of the other coniunction which is betweene the great Arterie and the arteriall Veine by a canale or pipe running betweene them, he thinketh ought to be referred to the maintenance of the life of the Lungs. For all life is from the vitall ſpirite and the arteriall blood, this is deriued by the riuerets of the arterie, which becauſe they no way pertayne or reach vnto the Lungs; it was of neceſsity that the great artery ſhould be vnited to the arteriall Veine. This is *Galens* demonſtration which haply wil ſeem to many obſcure, but I will make it brighter then the mid-day Sun.

Illuſtrated.

The Lungs in the Infant are red, much like the fleſh or *Parenchyma* of the Liuer, and thicker beſide then they are after a man is borne; red they are, becauſe they are both generated and nouriſhed by red blood: thicker becauſe they are neither attenuated by inſpirated ayre, nor yet moued perpetually as they are after the birth. For we do not think that the Cheſt of the Infant is moued in the wombe; if the Cheſt be not mooued then it is not likely that the Lungs are diſtended or contracted, becauſe the Lungs are not mooued by any proper or in-bred faculty of their own, nor by the pulſatiue faculty of the Heart, nor by the Brain; but onely they follow the motion of the Cheſt to auoyde vacuity, as wee ſhall hereafter more clearely proue when we come in the next Booke vnto the Hiſtory of the Cheſt. But when the Infant is borne the Lungs become ſuddenly more rare and ſpongy, and whiter

by

by much becauſe they are attenuated by perpetuall motion and by the permixtion of ayre breathed into them.

Wherefore the ſubſtance of the Lungs is not the ſame in the Infant when he lieth darkling in the corners of the wombe and when he enioyeth the vſe of the worlds light. If the ſubſtance bee not the ſame, neither is it proportionable that the Aliment ſhould bee the ſame. The Lungs being rare and ſpongy ſtand in neede of thinne blood laboured in the hotte and boyling right ventricle of the Heart, and therefore *Galen* thought that that right ventricle was onely made for the vſe of the Lungs. And as *Ariſtotle* firſt obſerued thoſe Creatures which haue no Lungs do alſo want the right ventricle of the Heart.

Now the thick, red and immoueable Lungs of the *Embryo* do not need blood attenuated, but are contented with that which is thicke and like themſelues. This craſſe and red blood is onely conueyed in the branches of the Hollow Veine. But how ſhould it attayne out of theſe branches of the Hollow veine vnto the Lunges, ſeeing there are no braunches from that Hollow veine diſperſed into the Lungs? for the Lungs haue onely three veſſels. The Venall Artery, the Arteriall Veine, and the Rough Artery. Heere therefore Nature with wonderful prouidence and Art, perforated the venal Artery which adioyned vpon the hollow Veine, therein to inoculate the veine, that ſo the bloode might haue a free paſſage for the nouriſhment and encreaſing of ſo fleſhy a bowell as the Lungs are; ſo that in the infant the venall Artery performeth onely the office of a veine, and may abſolutely then bee called a veine as well for his vſe as for his ſtructure. This therefore is the true vſe of that open hole, this the neceſsity of that famous inoculation.

Auicens opinion of the vſe of this Communion.

Auicen the Prince of the *Arabians* hath confirmed this demonſtration of *Galen*. *The Lungs* (ſaith he) *are red in the tender infant, becauſe he draweth no aer into them, for they grow not white but onely by the permixtion of breathed aer. They are therefore nouriſhed vvith redde blood, and to that end is the hole made out of one veſſel into another, which is preſently ſtopped after the Infant is borne.*

Second vſe of it.

Neither yet is this inoculation made onely for the Nouriſhment of the Lungs, but alſo for the firſt generation of their *Parenchyma* or ſubſtance. For it is out of doubt that the fleſh of all the bowels is made of the blood congealed or clodded together. This blood is onely brought by veines, but there were no paſſages from the hollow veine to the Lunges, and therefore there was bored an open and patent hole out of the Hollowe veine into the Venall Artery.

A third.

I will add a third vſe of this Communion, that that venal Arterie might bee formed out of the hollow veine. For a thin and venall veſſell could not ariſe out of the thicke & craſſe left ventricle of the heart: now it was neceſſary both that this veſſell ſhould bee fixed into the left ventricle of the heart and alſo be thin, that when wee draw in our breath it might ſuddenly receiue the aer, and when we exſpire it might expell fumid and ſootie vapors. It was neceſſary therfore, that the hollow vein ſhould be vnited with the venall artery; ſo that the venall artery may ſeeme to be a production of the hollow veine; and his firſt originall is not from the heart as is commonly imagined, but from the Liuer by the continuation of the Hollow veine.

The vſe of the other Communion which is betweene the great Artery and the arteriall Veine by the interpoſition of a Canale or pipe, I thus manifeſt. The Lungs do liue in the *Embryo*, therefore they ſtood in neede of vitall ſpirits and arteriall bloode for their conſeruation. This vitall ſpirits and blood are onely conteined in the branches of the great Artery; from this great artery into the Lungs there was at all no paſſage. Nature therefore leaſt the Lungs ſhould be defrauded of that quickning *Nectar*, made an arterial pipe perforated from the great artery into the arteriall veine, by which a part of the arteriall blood & vitall ſpirits might be conueyed vnto the ſubſtance of the Lungs.

The vſe of the the other cõmunion by the Canale.

I acknowledge alſo another vſe of this ſecond communion; that this arterial veine might take his originall from the *Aorta* or great artery. For the veine of the right ſide of the heart ſtood in neede to be Arteriall, that is, to haue a thicke coate like that of the Arteries. Now the fountaine of the Arteries was in the left ventricle. Wherefore Nature propagated the great Artery, and made out of it an Arteriall production or pipe which reacheth into the right ventricle, there to forme the arteriall veine; ſo that hence it is euident that the arteriall veine is a production of the great Artery, and the venall Artery a production of the hollow veine. So it is therefore with the veſſels of the Lungs in an infant yet contained in the wombe, that the venall artery performeth the office of a veine, the arteriall veine of an Artery,

Another vſe of it.

The vſe of the veſſels of the Lungs in the Infant.

tery, but the Rough Artery is altogether Idle. And this is the true demonstration of these two Vnions or Communions of the vessels of the heart in the Infant yet vnborne.

THE SECOND EXERCISE.

Wherein the new demonstration of the vse of these Communions divulged by Simon Petreus *a Physitian of* Paris *is confuted.*

BVT that the truth of this demonstration of *Galen* may bee more apparent, let vs a little examine some opinions of the late Writers concerning the vse of the Inoculations. *Petreus* is of opinion, that they were ordayned rather for the vse of the heart and the whole body, then for the Nourishment and life of the Lungs. And this is the summe of his demonstration, and these for the most part his owne words.

Petreus opinio The first intent of Nature is to make all things perfect, but the absolute perfection of her worke she doth not alwayes attaine by reason of the crosse or auerse disposition of the subiect matter, which *Aristotle* calleth the Hypotheticall or materiall necessitie? But what Necessity constrained Nature to produce these inoculations of the vessels? Surely the Necessity was very great, which if a man be ignorant of, he shal neuer vnderstand their history. The Vse and the Action is the end of Nature when she worketh & the scope or aime of the Physitian who searcheth into the workes of Nature, which scope if he neglect all Anatomy will be vncertaine, and all his inspection of the partes will but double theyr obscurity.

Aristotle often admonisheth, that the Organs are made for the Vse, not the vse applyed to the Instruments; whence it is that *Galen* first propoundeth the Vse and thereto recalleth the composition & Conformation of euery part: I will therefore first shew the vse and necessity of these inoculations of the vessels of the heart.

The vmbilicall Arteries do transmit from the Mother to the Infant Arteriall and Vitall blood, for they are inserted into his Iliacall Arteries. From these the blood ascendeth into the trunke of the great Artery, yea euen to his gate in the Basis of the heart, where it is constrained to make stay, becausse Nature hath set at that gate of the great Artery three Values whereby the passage is bolted from without inward, albeit from within outward any thing may passe. For this inconueniency and obstacle Nature deuised a present remedy. For considering that the blood labouted in the left side of the Mothers heart, and further prepared in the length of his way from the mother vnto the infant, was fit for the nourishment of his Lungs; she prouided that it should bee powred into the Arteriall Veine which is destined for the nourishment of the Lungs. And for that purpose she prepared in the infant a passage common to the great Artery and the arteriall Veine which is conspicuous aboue the *Basis* of his heart which we call *Anastomosis*. For the other *Anastomosis* I thus demonstrate the vse thereof.

Wee before determined that the arteriall bloode which the infant receyueth from his Mother by the vmbilical Arteries, is spent in the nourishment of the Lungs. Now it wil be worth our labour to learne how vitall bloode sufficient to bee diffused thoroughout the whol body is in the infant generated; for ther is no aer led by the Venal arterie into the left ventricle of the hart wherof the spirits should be made, becausse the infant breatheth not in the womb, neither getteth any thing into the hart by the great Artery, for the values which open outward and shut inward will admit nothing to enter. The lefte ventricle therefore of the heart had beene vnprofitable thorough want of matter and the discommodity of the place, vnlesse Nature had learned of her selfe to frame wayes for her owne behoofe more easie and expedite, which is the other *Anastomosis*, wherein shee hath wrought a worke beyond all admiration.

This *Anastomosis* is out of the Hollow veine into the venall artery, by which the bloode which is too much for the nourishment of the Lungs, is commodiously transported into the left ventricle of the heart, where it is labouted, confected and receyueth an impression of the vitall Faculty, and so turneth aside into the great artery which is neere neighbour and toucheth it, that by it it might be distributed into the whole body.

This demonstration I take to be most true, that the worke of this *Anastomosis* which is a very miracle in Nature might rather be referred to the vse of the whole body then vnto an vnprofitable commodity onely of the Lungs. Neyther doe I see by what reason it may

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be sayd that the Lungs of the Infant which doe not moue at all whilest it is in the wombe, should yet then require and dispend a greater quantity of Aliment and Bloud then they doe after the childe is borne, when for the generall behoofe of the body they are perpetually moued. For if those inoculations had beene made onely for the Lungs, they being greedy would haue drawne all the bloud by those patent passages which in growne men they drawe onely out of the Areriall Veine. Furthermore this absurditie would follow, that the vitall faculty of the Heart in the Infant must bee idle all the time of his gestation.

The summe of *Petreus* opinion.

This is *Petreus* his demonstation, wherein that I may speak in one word, he establisheth two things: the first that the Arteriall Canale or pipe was made for this purpose to poure out into the Lungs alone the arteriall and vitall bloud which the Infant draweth by the vmbilicall Arteries; so that he vnderstandeth that the vmbilicall Arteries weere not made for the vse of the whole body but onely of the Lungs.

The second thing he would establish is, that the Lungs are not nourished by the bloud brought thorough the hole of the hollowe Veyne into the venall Arterie, but that all that blood is transmitted into the lefte ventricle of the Heart for the Generation of the vitall spirits.

Petreus impugned.

Which two things how absurde they are and dissonant for true and right reason, I will endeuour to shew both by reason and sence, which are the two most certaine Iudges of all things.

In his vse of that Communion which is by an arteriall Canale or pipe from the great Artery into the arteriall Veine; I find some things contradictorie, and very many false and absurd.

A contradiction in his demonstration.

For sometimes he willes, that both the inoculations were made for the vse of the whole body, not for the commodity onely of the Lungs; afterward as if hee had forgotten himselfe, he writeth in his whole discourse that that Canale which is frō the great artery to the arteriall Veine serueth onely for the Lungs: VVhereas to make good his demonstration, he should haue sayed that the inoculation which is from the hollow Veine to the venal arterie is to be referred to the vse of the whole body; but that which is from the great artery into the arteriall Veine, onely to the nourishment of the Lungs. There is therefore in the first place a manifest contradiction; I forbeare to say howe improperly hee calleth the arteriall pipe an *Anastomosis*: becaule I am taught by *Aristotle* not to take too much care of words or to stand too much vpon them.

He vseth the word *Anastomosis* very improperly.

Galen indeed sayth that there are many *Anastomoses* or inoculations of veines & arteries, and that an *Anastomosis* is nothing else but an opening of the mouth of one veine or vessell into another, and those medicaments are called *Anastomotica* which haue a faculty to open. VVee also may vnderstand by *Anastomosis* the confluence of humours made when the vesselles doe open one into another. *Aristotle* in his Booke *de mundo* (if that Booke were *Aristotles*) vseth the word in another sence, when he calleth the ocean ἀνεστομωμένον, which *Budeus* interpreteth in *fauces se comprimentem*: but to call a Pipe, a Tunnell, a Vessell an *Anastomosis*, is a monster in Grammer, in Philosophy and in Physicke. Now *Petreus* words are these. *And for that purpose Nature prepared in the Infant a passage common to the great Artery and the arteriall Veine, which is conspicuous aboue the basis of his Heart which wee call Anastomosis.* Let any man now iudge, yea let himselfe see how farre this nouell speculation of his hath transported him: but this is but to play with him, let vs now set vppon him with keener weapons. He writeth that the arteriall bloud which the Infant draweth by the vmbilicall arteries, is wholly consumed in the nourishment of the Lungs, and that those notable arteries were onely made for their vse: then which what could he haue sayd or faigned more absurd?

He thinketh amisse that the vmbilicall arteries serue only for the Lungs.

Let him turne ouer all the writings of the *Grecians* the *Arabians* and the *Latines*, and hee shall see that they all accord in this, that the vmbilical Arteries were made for the vse of the whole body not of the Lungs alone. By these Arteries the whole *Embryo* doeth transpire and draweth the mothers spirits, not the Lungs alone. The vse therefore of the Arteries is common to the whole body of the infant. And this *Hippocrates* teacheth in his Bookes *de Natura pueri*, and *de Octimestri partu*, in these words, *In the middle of the flesh is the Nauell separated, by which the whole Infant doth transpire and attaineth his encrease.* Do not the artery in their Diastole or dilation draw aer and expel the sooty vapors in their Systole or contraction? There are made manie inoculations from the arteries into the veynes, therefore

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the aer is transported out of the arteries into the veines, not out of the veynes into the arteries.

Galen in his fourth and sixt Booke *de Locis affectis*, in his Booke *De vsu pulsuum*, in his Commentarie vpon the sixt sect. *lib. Epidem.* teacheth vs that transpiration is through the arteries not through the veines; and in his first Booke *de semine*, he sayeth. *The hole or passage of the membranes about the Nauel is alwayes open for the transmission of bloud and spirits, for bloud floweth out of the Veines, but out of the Arteries spirits with a little thin and hot bloud:* VVhat could he say more playnely, what more perspicuously? This also auoucheth *Auicen* the Prince of the *Arabians*, and finally it is the vniform consent of the Schoole of the *Grecians* and *Arabians*: and with vs this common consent of so great learned men shall euer stand for a law. But *Petræus* one man, of his owne head taxeth and challengeth all antiquity of error. VVell, wee will therefore no more contend with him with authorities, but by waight of argument.

Spiration double. Transpiratiõ and respiration.

It is an axiome in *Aristotle*, that all liuing creatures doe breath. For as a flame pent vp in a straight roome and not ventilated or breathed with aer groweth dimme and at length is extinguished, so our naturall heate is also extinguished vnlesse it be ventilated and wafted with aer as it were with a fanne. This spiration which the Grecians call πνοὴ or πνοὴ is double; the one insensible called διαπνοὴ, or *Transpiration*, which is made by the arteries and other blinde breathing holes of the body; the other may be seene with the eyes, and is made by conspicuous passages, as the mouth & the nosethrils which *Galen* calleth ἀναπνοὴν *Respiration*.

The infant doth not respire.

That the Infant in the wombe doth not *Respire* it is most manifest, because he neither ought nor can, as wee shall proue in our next question. It is necessary therefore that he must haue *Transpiration*, which is not by the vmbilicall veine, nor by the *vrachus*, & therefore by the two vmbilicall arteries; for there are no more but these foure vesselles in the Nauell. VVherefore this vse of the vmbilicall arteries is common to the whole Infant not proper onely to his Lungs.

Now that in the arteries not only aer as *Erasistratus* thought, but also a vitall spirit and arteriall bloud is conteined, we are taught by ἀυτοψία or *inspection*. The arteriall bloud then which the Infant draweth by the vmbilicall arteries is it not prepared for the life of the whole *Embryo* and the conseruation of the naturall heate? Doth the redde and thick *Parenchyma* of the Lungs, not at all as yet moued, stand in need of so great a quantity of thinne and arteriall bloud? If one veine which they call the *Nurse of the Embryo*, sufficeth for the nourishment of the whole Infant, why should not one small artery haue been sufficient for the nourishing and cherishing of the Lungs, which are a little part of the Infant? But Nature made two vmbilicall arteries and those notable ones, which are branched through the *Chorion* with infinite surcles.

That all the arterial blood is not spent in the nourishment of the lungs.

Moreouer, if all that bloud that the Infant draweth by the vmbilicall arteries were consumed in the nourishing of the Lungs, then these absurdities would follow. First, that the Lungs are not nourished with bloud like vnto their substance, nor with pure bloud. For the vmbilicall arteries doe returne the bloud into the Iliacke branches, and from them into the trunk of the *Aorta* or great arterie; wherefore the arteriall bloud of the mother shall bee mingled with the arteriall bloud of the Infant, which hee sayth is generated in the left ventricle of the Heart, and thence diffused into the pipes of the great artery: and so it will come to passe that one of them shall offend another; for in the same vessel there shall be at one & the same time perpetually two contrary motions: one of the bloud ascending from the Iliacke braunches to the Lungs; and another of the arteriall bloud descending from the lefte ventricle of the Heart to the same Iliacke branches: which thing albeit we confesse, it sometimes hapneth in Critical euacuations and notable indeuours of Nature: so, that it should be perpetuall we cannot be perswaded. Let vs then wipe away this myst from our eyes, and let vs beleeue that the two vmbilicall arteries were made for the vse not of the Lungs alone, but also for the whole body. Now let vs come vnto the vse of the other Inoculation.

His vse of the other inoculation impugned.

Petreus conceit is, that the hollow Veine is perforated into the venall Artery, that the bloud might be powred into the left ventricle of the Heart for the generation of vitall spirits, neither doth he acknowledge any other vse thereof. But wee with *Galen* thinke that it was formed for the generation and nourishment of the Lungs. For if there be a new generation of vitall spirits in the left ventricle of the Heart, made of the bloud which is conuayed in the hollow Veine as *Petreus* would haue it; then what neede was there of that

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hole or perforation? Doth not the hollow Veine gape into the heart with a wide mouth to poure abundance of blood into his right ventricle? Why is not the blood there boiled & attenuated, and after sweateth through the partition into the left ventricle; and there receiue the stampe or impression of the vital spirit; The blood so attenuated in the right ventricle would be purer and more defæcated, then if it should be transfused out of the hollow Veine into the left ventricle by that *Anastomosis*; there would haue therefore beene no necessity of vitall spirits, but for the nourishment of the Lunges there is absolute necessity thereof.

Againe, it is an axiome in Physicke and Philosophy which *Galen* often beateth vppon, that there is neuer made any perfect elaboration vnlesse a preparation go before. So the Animall spirits are prepared in the webs of the braine; the seed is delineated in the writhen complications of the seede vessels; the blood attaineth a rudiment in the veines of the Mesentery; and the preparation to the third concoction is made in the small veins of each particle. But if according to *Petreus* Hypothesis, the blood should be transfused from the hollow Veine into the venal Artery which toucheth it, and from that into the left ventricle of the heart, where I pray you shall that blood be prepared or attenuated? If that newe conceite of the Generation of vital spirits in the infant were to be admitted at all, it were more probable to say, that the blood were powred out of the hollow Veine into the right Ventricle and there prepared, because the Membranes do not hinder the ingate heereof, and beside the partition is bored with so many passages to conuey it into the lefte. For it is the opinion of all learned men, that the right ventricle was ordained for the preparation of the vitall spirit. 2. Reason.

Moreouer, it is most certaine that there is a double matter of the vitall spirite, Aer and Blood; Now *Petreus* doth not thinke that aer is carried into the heart, for the infant in the wombe doth not respire, how then shall that vitall spirit be generated and preserued? Out of doubt it will decay and bee extinguished beeing defrauded of conuenient Aliment. *Hippocrates* in his Booke *de Natura pueri* saith, *Euery thing that is hot is nourished with that which is moderately colde*. Indeed Transpiration is sufficient to preserue a little heat; but for the perpetuall generation of vitall spirits in bloody Creature sthere is required great abundance of aer, which onely can be supplied by Respiration. But let vs pursue these Detractors a little farther. 3. Reason.

If we shall admit this new and onely vse of the hole or inoculation, that is, that all the blood should be conueyed from the Hollow Veine through the venall Artery into the lefte ventricle of the heart, with what blood shal then the Lungs be nourished? Open the waies? shew me the veine of the Lungs? For now al the venall Arterie is taken vp, forsooth, to lead blood vnto the heart, and the Arteriall Veine only leadeth vitall spirits and arteriall blood which it receyueth from the Great Artery by the Canale or arteriall pipe. Shall the Lungs be without aliment? He wil answere, that it is nourished with arteriall blood which commeth from the Mother, and that for that purpose the two vmbilicall arteries were ordained. But hath he forgotten that all parts want two sorts of blood, one Venall, another Arteriall? The venall blood by true assimulation turneth into the substance of the part. The arteriall is appointed to conserue, refresh and cherish the naturall heate of the particular parts which is but fugitiue. 4. Reason.

I will not deny but some part of the Mothers arteriall blood is conueyed into the Lungs by the arteriall pipe to preserue their life and to defende their naturall heate, but that the Lungs are therewith nourished, I altogether deny. For the Lungs of the *Embryo* are thicker, faster and heauier then they are after the birth, and therefore must be nourished with thicker blood, for it is a constant truth, that we are norished with that which is like vnto vs; euen euery particular part is nourished with that which is most like vnto it.

This Law and Constitution of Nature, *Petreus* by this new demonstration doth quite abrogate and annihilate, because he appointeth thinner blood for the Lunges of the infant which are red, heauy, sad and thicke, then for the Motherswhich he must confesse are whiter and thinner. For the Mothers Lungs are nourished with blood attenuated in the right ventricle of the heart, and deriued vnto them by the arteriall Veine: hee stiffely maintaines that the Lungs of the *Embryo* are nourished with no other then arteriall bloode laboured and heated in the left ventricle of the Mothers heart and brought vnto them by the vmbilicall arteries, forsooth, to make recompence for their want of motion. Heere also we haue a manifest contradiction. He confesseth that the Lunges are thinner after birth, thicker in the

He abrogates the Lawes of Nature.

Another contradiction in *Petreus* demōstration.

the *Embryo*, and yet he saith that the first are nourished with thicker blood, the latter with pure arteriall blood full of spirits.

Galen expounded.

And whereas he buildeth vpon *Galens* foundations that the Lungs are made of the froth of the blood; and therefore do require for their nourishment thin and arteriall blood. Hee seeth not that that place is to be vnderstood of the Lungs after the birth; for in the Infant the Lungs are not froathy nor whitish, but red, heauy and thight, yea euen a while after the birth doe the Lungs remaine heauy and red; whence it commeth to passe that many Infants shortly after their birth are strangled, because the Lungs cannot play themselues, eyther when the childe lyeth vpon his back, or by some compression of his Chest; and therefore it is best to lay Childeren with their heades somewhat eleuated or raysed vp, that the Lungs which are heauy may more easily followe the contraction and distention of the Chest.

How children are often strangled. How to remedy it.

Those Children which dye so suffocated if they bee opened will bee found to haue their Lungs full of thicke bloud, and very red. But let vs heare *Galen* accurately describing the Lungs of a tender Infant in the sixt Chapter of the 15. Book *de vsu partium*, in which place he of set purpose expresseth the History of the Infant. *Why are the Lungs of an Infant redde and not whitish as afterbirth? Because they are nourished with bloud brought vnto them by vessels which haue but a single coate.* And then he addeth, *When the creature beginneth to respire the Lungs are moued perpetually: whence it is that the bloud being diuided by the double motion of the breath it made thinner then before and as it were frothy, and so the flesh of the Lungs which before was redde, heauy and thight, becommeth white, light and rare or spongy.* How pregnant and plaine a place this is who seeth not? The flesh of the Lungs of the Infant is red, heauy and fast, and afterward becommeth thinner and frothy: wherefore the Lungs of the *Embryo* stood neede of red and thicke bloud, which kinde is onely conueyed by the rillets of the hollow veine, not through the thicke pipes of the great Artery. But there are no passages from the hollow veine to the Lungs, and therefore Nature made that admirable *Anastomosis* for the nourishment of the Lungs. And thus *Petreus* ought to haue playd the Philosopher, and not to haue abused that which *Galen* intendeth concerning the nourishment of the Lungs after birth, to the nourishment of the Lungs of the *Embryo*, in the mothers womb. But if he wil not yeeld to these reasons which are cleare demonstrations, then wee cite him to the tribunall of trueth to αὐτοψίαν, that is, to ocular inspection. Cutte the Lungs of the *Embryo* and you shall see all the branches of the venall Arterie full of red and thicke bloud. From whence, good *Petreus*, is that bloud, is it not from that hole of the hollow veine?

A pregnant place in *Galen* against *Petreus*

Arguments from *Autopsia*.

We conclude therefore that that admirable *Anastomosis* or inoculation was framed by Nature, not for the elaboration of the vitall spirit, but for the generation, nourishment & increment of the Lungs. Thus much we thinke our selues bound to haue sayd, not onely to redeeme the credite of our maister *Galen*, but especially to vindicate and redeeme the trueth, albeit it be with the losse of a learned man, such as we willingly acknowledge *Petreus* to be; but he must be content to suffer himselfe to be gaynsayed if he gaynsay the truth; and if any thing fal from vs in discourse which may sound somwhat more harsh in his eares or those that follow him, that also must be attributed to the heate of disputation, for much may be forgiuen a Souldeir when he is heated in the medley which might bee imputed to him for cruelty in cold bloud.

THE THIRD EXERCISE.

Another new Demonstration of the vse of the Inoculations, deuised by Francis Rosset, a learned Physitian belonging to the French King.

Rosset's opinion of the vse of the Inoculations.

LAurentius reports that when Doctor *Francis Rosset* the French Kings learned Physitian heard of this difference of opinions betweene him and *Petreus* concerning the vse of the Inoculations, he wrote vnto him that he had found out a new vse of both these Communions of the vesselles of the Heart in the Infant, and that he sent also to him this Table which we haue annexed.

His opinion is, that both these Inoculations were ordayned onely for the conueyance of aer, directing it to the Lungs before it should come at the Heart, and mingling it with both kindes of bloud venall and arteriall prepared before in the Liuer and the Spleene: For as after birth the outward aer is not carried crude & raw into the hart, but passing through

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rough artery is prepared in the rare substance of the Lungs, and is made fit for the heart; so in those that be not yet borne the internall aer must necessarily come to the Lungs for the same end where it vndergoeth a peculiar Castigation before it bee admitted to the heart. Moreouer, from the thinnesse of that aer and the pulsatiue motion of the heart this commodity the Lungs must needs haue, that their *Parenchyma* in the infant & the vessels therein are accustomed and prepared to the motions of Expiration and Inspiration which are to follow after he is borne, for the aer enlargeth the pores in them and so fitteth them for the vse of the childe when he cryeth.

Wherefore the two inoculations in the infant vnborne, and the rough arterie after the birth may be compared to *Castor* and *Pollux*, of which when one ariseth the other is destinied to set.

In The Infant.

To be Borne,		*Already Borne,*	
Do Worke,	Are Idle.	Do Worke,	Are Idle.
1. *The Chorion, the Stomacke beeing idle.*	1. *The Stomacke, the Chorion worke ing.*	1. *The Stomacke, the Chorion beeing Idle.*	1. *The Chorion, the Stomacke vvorking.*
2. *The Vmbilicall vessels, the vessels of the Mesenterie being idle.*	2. *the vessels of the Mesentery, the vessels of the nauell working.*	2. *The vessels of the Mesenterie, the Nauell vessels being idle.*	2. *The Nauill vessels, the vessels of the Mesenterie working.*
3. *The Vrachus, the Vreters being ydle.*	3. *The Vreters, the vrachos vvorking.*	3. *The Vreters, the Vrachos beeing Idle.*	3. *The* Vrachos, *the Vreters working.*
4. *The Inoculations of the Heart, the Rough Artery or Weazon being idle.*	4. *The weazon or Rough Artery, the Inoculations working.*	4. *The Rough Arterie, the Inoculations beeing Idle.*	4. *The Inoculations of the Heart, the rough artery working.*

The Exposition of the Table.

Euen as the operation at certaine times, and the rest at others, of the three first, to wit, the Chorion, the Nauell vessels and the Vrachos is answereable to the other three set against them, to wit, the Stomacke, the Mesentery vessels and the vreters, each one respecting his consort or substitute in the administration of one and the same thing necessary to life: so likewise is there the same succession of operation and rest at different times betweene the fourth paire of Consorts, to wit, the inoculations of the heart and the rough Arterie or Weazon, in the administration of one and the same thing necessary to life. *Rosset* his demonstration.

For seeing there can be nothing found nor imagined in the whole bodye, which in the wombe, when the rough artery is at rest, should supply his office which is necessarie to life, vnlesse it be the inoculations of the vessels of the heart; which inoculations in the wombe do worke but cease their labour when the infant is borne, the rough Artery then vndertaking his incessant labour himselfe: it must needs follow that the vse of the inoculations in the wombe is the very same that there is of the rough artery after the infant is borne. Now all men acknowledge that the rough artery is ordained for the transuection or transportation of the externall and ambient aer to the Lunges of the infant which prepare it, for the heart standeth in neede of aer so altered. Wherefore the true vse and office of the inoculations (which onely haue vse whilst the infant is in the wombe) is the transvection or transportation of aer (but that internall comming out of the Mothers womb through the Chorion and the vmbilicall vessels) to the same Lungs of the infant which are to prepare it for his heart.

The 11. moth the last time.

The last limit is the eleauenth moneth, the times betweene are the ninth and the tenth.

Rossets opinion disproued.

This is *Rossets* opinion, wherein he laboureth to establish, that both the *Anastomoses* or inoculations are appoynted onely to leade ayre to the Lungs, and that by them the Infant doth respire and the Lungs are moued for the new generation of vitall spirits. But our opinion is, that the Infant doth not at al Respire but Transpire only, as we shal shew in the next question; neither yet doe we thinke that it was necessary there should haue bin made so notable inoculations if only the conueyance of ayre to the Lungs had bin necessary. For seeing in perfect creatures and those that haue most vse and strength of voyce, there is but one weazon or rough Artery ordayned, why should not one inoculation haue serued in the Infant whilest yet he maketh no vse of his Lungs for voice? It had bin more probable if he had said, that one of the Inoculations was made to leade ayre the other to lead bloud.

Moreouer if onely ayre be ledde by these inoculations to the vessels of the Lungs, why doth there appeare in the venall Artery so redde bloud, and in the arteriall veine arteriall bloud full of spirits? With what bloud shall the red and thicke Lungs of the Infant be nourished? In a tender Infant that Transpiration which is made by the arteries & other blind passages is sufficient for the conseruation and refection of his weake heat.

The conclusion.

We conclude therefore that both the inoculations were originally made to generate and nourish the Lungs, because whereas the Lungs of an Infant before birth do differ frō his lungs after birth, in colour, thickneſſe and fastnes of flesh; they needed also another kind of bloud for their generation and nourishment before then they do after. And thus we are come to an end of that admirable worke of Nature in the inoculations of the vessels of the Infants Heart.

QVEST. XXVI. *Whether the Infant in the wombe doe respire and stand in need of the labour of his Lungs.*

What respiration is.

COncerning the nature of Respiration we shall haue a fitter place to dispute in the next Booke where we treate of the Lungs. In this place it shall bee sufficient to giue you *Galens* description thereof in his Commentary vppon the Booke *de salubri diæta*, where he sayth. ἀναπνοὴ *or Respiration, is when the breath is drawne in and let out by the mouth*: so that in Respiration it is necessary the Chest should be contracted and againe dilated and the Lungs moued thereafter. If therefore I shall prooue that in the infant the Chest is not contracted or dilated nor the Lungs moued, it will follow that he doth not Respire but Transpire only.

That the Infant doth transpire only not respire in the wowbe.

The vitall faculty in bloudy and hot Creatures stands neede of two things for the conseruation therof, Respiration and Pulsation: but those Creatures which are without bloud and imperfect, which haue little heate, doe liue contented onely with the Pulsation of the Arteries and transpiration. So those we call ἔντομα and which liue in holes all winter doe transpire but respire not: so likewise *Hysterical* women, that is, such as are in fits of the mother, the heate of whose heart is languid and weake being dissolued by a venemous breath of corrupted seede, do liue a time without respiration, and many haue been buried for dead when they were yet aliue.

The Infant because he hath but a weake heate; and is in the wombe before the day of his birth as it were an imperfect creature, is contented onely with transpiration and therefore he draweth not his breath by his mouth, neither vseth hee the helpe of his Chest or Lungs. Moreouer Respiration is onely ordayned for the behoofe thereof, that the spirituous substance which is established in the glowing hot left ventricle thereof the, might with the ayre be cooled as it were with a fanne, and beside purged and refreshed; but there is no generation of vitall spirits in the Infant, as by and by wee shall demonstrate: and therefore there is no neede of respiration; for the finall cause fayling which moueth all the rest Nature is too wise to vndertake any labour. The infant therefore doth not respire because he *ought* not.

The Infant neither ought nor can respire.

Adde hereto that hee neither *can* respire: for being shut vp in his mothers wombe and compassed about with membranes, if he should draw in breath at his mouth with the ayre he should also draw in the water wherein he swimmeth, and at the first draught would be so suffocated as they that are drowned in a riuer. Again, he hath no ayre that he might draw, for there is no space in the vvombe that he doth not fill, and beside the orifice of the vvomb is so close locked vp that it vvill not admitte a little vvinde to enter into it. Again, that no ayre is inspirated by the mouth or the nosethrils, the substance and colour of the Lungs do suf-

ſufficiently declare. For all creatures which draw aer at their mouths and noſes haue white and thin Lungs, but the Lungs of the infant, as hath beene often ſaide, are red and thicke, and are nouriſhed with red and thicke blood brought vnto them by veſſelles hauing ſingle coats, that is, by veines. Wherefore the infant doth not reſpire, becauſe neyther ought hee if he could, nor can if he ought. *Roſſet* Obiects, that by both the inoculations there is plenty of aer tranſported to the infants Lunges, becauſe it dilateth and contracteth his Cheſt: But if that were ſo, then ſhould it follow that the Cheſt is mooued after the motion of the Lungs; for the Lungs being puffed vp by the aer inſpirated ſhould enlarge the cheſt; and againe falling vpon the expiration of the aer ſhould compreſſe the ſame. So the lungs ſhould not be filled becauſe the Cheſt is diſtended as it is in a paire of bellowes; but becauſe the Lungs are filled the Cheſt ſhould be diſtended as it is in a bottle or bladder, which to ſay were very abſurd, as *Galen* teacheth in a thouſand places. For the Lungs follow the motion of the cheſt for the auoiding of vacuity, as in the next booke we ſhall more plainly proue.

Roſſets obiecti. an anſwered.

Neither is the diſtention and contraction of the Cheſt ſimply neceſſary for the maintenance of life; for thoſe creatures which lurke in holes all winter, we cal thẽ φωλεύοντα ζῶα, & ſome women do liue without that motion of the cheſt. Reſpiration therfore in the *Embryo* or young infant is not abſolutely neceſſary.

Reſpiration is not abſolutely neceſſarie to life.

Some there be, who thinke that infants doe reſpire in the wombe as diuing Fiſher-men; who will remaine more houres then one in the bottom of the water, and returne freſh vp and laden with Fiſh. Why ſhould not the infant being warme in the womb as wel liue, his weazon haply a litle helping him, as the cold fiſher draw aer out of himſelf with his mouth being compaſſed round about with cold water? The ſame thing alſo they confirme by the authority of many authentic all authors. *Hippocrates* in his Booke *De Natura pueri* ſaith, *Firſt the infant breatheth a little and draweth a little blood from the wombe; and his breathing is encreaſed when he draweth more blood, it deſcending more p'entifully into the womb. Galen de locis affectis*, If the heart be depriued of Reſpiration, the man muſt of neceſsity inſtantly periſh. Is not the infant a man? Furthermore, women feele their infants to mooue with Animall and voluntary motion. Why therefore are not the Lungs and the heart moued. As therefore in the firſt months when the infant beginneth to moue, he is truly ſaid to mooue though it be obſcurely: ſo though he breatheth obſcurely, yet he may truly be ſaide to reſpire. *Galen* in his 4. Book *de cauſis pulſuum* ſaith, that women with child haue greater, quicker and ſwifter pulſes then they haue when they are not with childe; becauſe they are compelled to breath not onely for themſelues but alſo for their infants. But all theſe thinges do prooue indeede that infants do tranſpire, but they do not prooue that they do reſpire. For, in reſpiration the Cheſt is contracted and diſtended and aer is breathed in by the mouth & the noſe; which that it is not ſo in the infant we haue already demonſtrated. Indeede by the vmbilical arteries there is aer tranſported togither with the ſpirituous blood into the whol body of the infant, & from the arteries there are many inoculations into the veins; whence it commeth to paſſe that though the arteries be tied, yet the creature doth not preſently die as being a while ſuſtained by that aer which the whole body receiueth from them.

That the infãt doth riſpire. A compariſon

Authorities.

The Solution of the Arguments.

QVEST. XXVII. *Whether the vitall Faculty which procreateth the ſpirits is idle in the infant, and whether his heart is mooued by it owne proper power. A Paradoxe.*

A paradoxe, that the vitall Faculty of the heart in the infant is idle.

COncerning the life of the Infant, that is, how hee excerciſeth his vital faculties there is a new Paradoxe, which we will Diſcuſſe. I doubt not but at the firſt view it will ſeeme to many men abſurd, but if it bee better attended I preſume it will appeare ſo ſtrong and ſo wel ſupported with ſtrong demonſtrations that it will be hard for a contentious ſpirit to ſhake them. The Paradox is this: *There is in the infant no neceſsity of the lungs & the heart, becauſe he liueth without their offictal action.*

This if I can prooue, I ſhall ouerthrow the iudgement and determination of *Ariſtotle* & the Peripatetiks concerning the ſoueraignty of the Heart in mans body. The demonſtration of our Paradox ſhalbe wholy Phyſiologicall and Anatomicall.

The Demonſtration.

The Faculties of the Soule are reckoned by *Ariſtotle* to be three, the Vegetatiue the Senſatiue, and the Intellectuall. The Phyſitians account ſo many, but giue them other Names: The Naturall, the Vitall, and the Animal. That which the Peripatetiks call the Vegitatiue differeth nothing from the Phyſitians Naturall. For as we ſay the whole Natural Faculty is con-

conteined in the *Increasing*, *Nourishing*, and *Procreating* vertues; so *Aristotle* in his second *de Anima* saith, that the same vertues serue the vegetatiue soule. This vegetatiue faculty is common to all things that are animated, that is, which haue any kinde of life in them, and proper to them onely. For all things that haue life are nourished, but the Vital faculty of the Physitians, which is the procreator of the spirits of life, which shineth in respiration and in the pulse, doth not appeare in plants and things without bloode, because their colde and erasse spirits are scarse at all expended or wasted. In hotter creatures there was neede of a fire-hearth, from whence the vanishing heate of the particular parts might bee redintigrated and refreshed by the influence of another. That liuely and quickning *Nectar* is the vitall spirit which the heart ἀρχὴ τοῦ θερμοῦ καὶ τοῦ ζῆν, *The Originall of heate and life* continually generateth of bloode and aer mingled together by his admirable motion, as a water Engine worketh vp a streame. That this vital faculty of the Physitians doth not shine in the infant neither yet his heart mooue by a proper and ingenite power although he liue, we are fully perswaded by these arguments.

The first Argument.

The heart is mooued to generate vitall spirits, and the same to diffuse out of his left ventricle as out of a liuing fountaine to the channels of the great Artery to refresh the fading & decaying heat, to supply by his sourse of vitall spirits the liuelode of the particular parts. This is all the necessity of his perpetual motion, this the Final cause. But in the infant there is no generation of vitall spirits in the ventricles of the heart, neither are vitall spirits derived from his heart into the Arteries; *Ergo* his heart mooueth not, there being no necessity of the motion.

What necessity there is of the motion of the heart.

The *Maior* proposition of it selfe is cleare enough. For who seeth not that in the Diastole or distension of the heart, both the matters of the spirit Aer and Blood are drawn into the heart? The Aer by the Venall artery into the left ventricle, the bloode by the hollowe veine into the right: againe, that in the Systole or contraction of the heart both the sooty vapors which are the recrements of the spirits are purged, and the vitall spirits driuen into the pipes of the great artery as into water-courses? Insomuch that this generation of the spirits which it accomplisheth by his perpetuall motion seemeth to be the onely officiall action of the heart. The *Minor* proposition is thus confirmed.

There is no generation of vitall spirits in the infant.

The vitall spirit is generated of aer and blood mingled together. Both the matters before they attaine the left ventricle of the heart do stand in neede of preparation. The aer by his abode in the substance of the Lungs attaineth a quality familiar to the inbred spirit. The blood is prepared in the right, which they call φλεβώδη and the bloody ventricle. But in the infant there is neyther any plenty of aer conueyed into the Lungs, (for the Weazon is idle) neither is there any bloode powred into the right ventricle. There is therefore in the heart of the infant no shop nor worke-house of the vital spirits. That neither Aer nor Blood is deriued into the Ventricles of the infants heart is manifestly prooued by the structure of his vessels. For the vessels are vnited; the hollow veine and the venal artery by a large hole, the great artery and the arteriall veine by an arteriall pipe or Canale: wherefore the Hollow veine doth not poure blood into the right ventricle, as it doth after we are borne, but into the venall artery through that hole for the nourishment of the Lungs. The venal artery leadeth not aer but blood, and that thicke and venall. The great artery doth not drawe spirits from the heart but from the vmbilicall arteries, which it transinitteth by the arteriall pipe into the arteriall veine.

Now if the vitall spirits were generated in the left ventricle of the heart, what need were there of that Arteriall pipe, seeing there is in the heart a wide vessell which is diuersely dispersed through the whole substance of the Lungs, I meane the venall artery? This surelie is a strong demonstration whose force no man can perceiue, vnlesse he be skild in Anatomy, for it dependeth wholly vpon ocular demonstration, and the credite of a mans owne sight. But this we will establish by other reasons.

The seoond argument.

There is in the infant no necessity of that common storehouse or worke house of the spirits, because the two vmbilicall arteries do supply vnto him arteriall blood, and a sufficient proportion of vitall spirites and those very pure and bright, as beeing made by the strong heate of the Mothers heart. Nature doth nothing idly or in veine, why therefore should she make two vmbilicall arteries if new arteriall blood were to be generated in the infantes heart? You will say that the Mothers arteriall blood was vnprofitable, and not so fit for the vse of the infant, and therefore it needed to be re-boyled by his heart. But I desire to bee shewed the wayes whereby that arteriall blood can be transmitted into the left ventricle; by

There is no necessitie of new vital spirits.

the

the mouth of the great artery it cannot passe togetherward becauſe Nature hath bolted it with 3. values which look from within outward; albeit we think with *Galen* that ſome ſmall quantity of the bloud ſypeth into the Heart to nouriſh it and preſerue his life. From the great artery it is freely powred into the arteriall veine through the arteriall pipe, but from the arterial veine into the heart there is no way open: for the membranes or values of this veſſell are open outwardly but cloſed within, which giue way to any thing that commeth out of the hart, but do intercept the returne of it into the heart. Seeing therfore that the arteriall bloud of the mother doth not forſake the Arteries, neither hath any acceſſe vnto the left ventricle of the Infants heart, wee cannot admit any new preparation of the old, or preparation of any new.

Again, if that the ſpirit of the mother and the arteriall bloud be prepared for the nouriſhment of the Lungs, and for the conſeruation of their heate, as *Petreus* would haue it: why alſo ſhould not the other parts of the body liue by the influence and illuſtration of the ſame ſpirite? Or if the heart of the Infant doe generate vital ſpirits whereby the life of the whole is preſerued, why ſhall it be thought inſufficient for the preſeruation of the Lungs which are but a little part of the whole? Wherefore the Infant truely liueth by his owne proper life, but he neuer ingendreth new ſpirits nor hath any vſe of the motion of the heart. Notwithſtanding wee muſt not ſay that therefore the heart is idle, for Philoſophers ſay, that is onely idle which doth not worke when it ought and when it can. The third argument. Why the hart of the Infant cannot be ſaid to be idle.

The Heart of the *Embryo* neither can make vitall ſpirits, nor ought if it could. It ought not, becauſe the two vmbilicall Arteries doe ſupply both a ſufficient number of ſpirites and thoſe alſo very pure. Nether can it, becauſe there is a want of matter, for it hath no ayre which it ſhould draw.

As therefore we doe not acknowledge any new Chilification or Sanguification in the Infant, (for where ſhould the recrements of either of them be reſerued or treaſured for ſeauen months together.) So neither doe we admit a new generation of vitall ſpirites in the Heart of the Infant. But you will obiect that Infants Arteries are mooued, and all motions of the arteries are from the Heart, becauſe the Heart and the Arteries are continuated together. VVherefore if the Arteries be mooued together with the Heart, it will follow neceſſarily that we muſt admitte in the Infant the vitall faculty by which the ſpirites are ingendred. Obiection.

I anſwere, that the Arteries of the Infant are indeed moued, but that their motion followeth or floweth from the Arteries of the mother; ſo that his Arteries doe not beate by a proper and ingenite faculty of their owne, nor by any power iſſuing from his heart, but by a force and efficacy tranſmitted from the heart and the arteries of the mother. That theſe things are thus, this elegant demonſtration I thinke will ſufficiently proue. It is moſt certaine that the Veines and the Arteries of the wombe doe ſo adhere to the Veines and Arteries of the *Chorion*, that both arteriall and venall bloud doe flowe out of one vnto the other. And this continuity of the veſſels, *Galen* maketh often mention of, for in his Booke *de diſſectione vteri* he ſayeth, *The end of that veſſell which is propagated through the wombe, giueth beginning to that which is in the Chorion, ſo that you may call theſe two one veſſell*, for their mouthes are ſo vnited, that the Veine draweth bloud from the Veine, and the Artery ſpirit from the Artery. Anſwere. The arteries of the Infant are moued after the motion of the mothers arteries. The first demonſtration.

If this be true in the Arteries ſo opening into the mouths either of other, it muſt needs follow that the end of the artery of the mothers wombe when it beateth muſt driue arteriall bloud into that part of the *Chorion* which is continuall therewith, otherwiſe that arteriall bloud muſt either recoyle into the wombe out of the which it is iſſued; or elſe there muſt bee a conculcation of two bodies confuſed and mingled in the ſame time and place, mutually penetrating one the other; whence it ſhall come to paſſe that if we graunt there is a dilatation in the *diaſtole*, wee muſt alſo yeelde that there is at the ſame time and in the ſame veſſell a compreſsion in the *ſyſtole*.

Furthermore, is it not true which the Philoſopher ſo often vrgeth, that a part of that which is continuall being moued the whole is moued vnleſſe it bee hindered? The arteries of the Infant are continuated with the arteries of the mother; therefore when the mothers arteries are dilated, it is of neceſsity that the arteries alſo of the *Chorion* muſt be dilated. But if that pulſatiue faculty did flow from the heart of the *Embryo*, there ſhould flowe alſo vitall ſpirits from the left ventricle into the arteries of the Infant, which alwayes be accompanyed with arteriall bloud, and ſo the arteriall bloud of the mother ſhould bee alwayes mixed The ſecond.

with the arteriall bloud of the Infant; and there ſhould be a double motion in the arteries of the Infant, one from the heart of the *Embryo*, the other from the mothers arteries which would not be anſwerable but contrary the one to the other.

VVe conclude therefore that the Arteries of the Infant are moued after the mothers arteries, becauſe they are continuated with them: and therefore that that vitall faculty which procreateth the vitall ſpirits and the arteriall bloud, muſt by no meanes be admitted to bee in the Infant.

Galens opinion. *Galen* ſometimes ſeemeth to haue beene of this opinion: for in his Booke *de formatione fœtus*, hee ſayeth that the Infant liueth after the manner of a Plant; and therefore ſtandeth neither in neede of the action of the Heart nor of the Brayne, as neither of the eyes nor of the eares. As therefore a Plant oweth all his life vnto the earth, ſo the Infant oweth all to the mother: yea ſometime hee ſayeth that the Infant is as it were a part of the mothers body. As therefore a part of the body needeth not any particular reſpiration, nor any particular ſtomacke to digeſt his Aliment, yet of neceſsity requireth the pulſation of Arteries; ſo the Infant liueth contented onely with tranſpiration, which is accompliſhed by the *Dyaſtole* and *Syſtole* of the Arteries.

Galen. In the 21. Chapter of his ſixt Booke *de vſu partium* *Galen* ſayeth, *Wee neede not wonder that the Heart of the Infant to his proper life needeth but a little ſpirit, which he may draw out of the great Artery, ſeeing it ſendeth neither bloud nor ſpirits to the Lungs nor to the Arteries of the whole body as it doth in perfect creatures.* VVhere marke that hee ſayeth, *The Heart may draw a little out of the great Artery.* For the values or floud-gates there ſet by Nature, do not hinder a little arteriall bloud and ſpirites from ſiping into the Heart, but they hinder a ſudden and plentifull confluence, ſuch as ſhould be neceſſary, if of them the Heart ſhoulde make vitall ſpirits and arteriall bloud for the whole body of the Infant.

The contrary opinion. This I ſay was *Galens* opinion: yet in many places he ſeemeth to ſay the quite contrary; that the Arteries of the Infant are moued by a faculty ſent from his Heart vnto them, and that the Heart it ſelfe is moued by an in-bred and proper motion. In the 22. Chapter of the ſeauenth Booke *de vſu partium*. *The Heart* (ſayth he) *not onely in perfect creatures but alſo in Infants, ſupplyeth to their Arteries the power by which they are moued*: and in 21. Chapter of the ſixt Booke, *If you tie the Arteries of the Nauel whilſt the Infant is in the womb, all the Arteries which are in the Chorion will ceaſe beating, & yet thoſe Arteries which are in the body of the Embryo will continue their pulſation: but if with the vmbilicall Arteries you tye alſo the vmbilicall veines, then will the arteries which are in the body of the Infant leaue beating alſo.*

That the arteries of the Infant are moued by a power iſſuing from his hart.

Authorities out of *Galen.*

By which it is manifeſt, firſt that that power which moueth the arteries of the *Chorion* proceedeth from the heart of the Infant; againe, that the arteries get ſpirits from the veines by their inoculations. In the ſame Booke in another place hee ſayeth, *The Heart in the Infant when it dilateth it ſelfe, draweth bloud and ſpirites from out of the venall Artery.* In the ninth Chapter of his Booke *de formatione fœtus*. *When the Heart of the Infant commeth to haue ventricles, and hath receiued venall and arteriall bloud, then it pulſeth, and together with it ſelfe moueth the Arteries, ſo that it liueth now not onely as a Plant, but alſo as a Creature.* This opinion may alſo be confirmed by reaſons.

The firſt argument. Seeing the Heart is the hotteſt of all the Bowels and as it were a fire-hearth, if you depriue it of motion it hath nothing left wherewith it may bee refrigerated; by tranſpiration it cannot, becauſe it is included in a hotte and narrow roome, nor by the appulſion of externall ayre; for the ſolidity and thightneſſe of the membranes wherewith it is compaſſed hinder the acceſſe thereof; adde hereto that thoſe watery excrements doe hinder the perſpiration. Neither hath the Heart of the Infant any refrigeration from the mothers arteries by the acceſſe of a new matter or ſpirit, for nothing can ariue into the Heart of the Infant from his arteries becauſe of the membranes which lye vpon the mouth of the great arterie.

The 2. argument. The motion therefore of the Heart was neceſſary, by the benefite whereof both bloud and ſpirit are drawne into it, and from thence communicated to the whole body. The credite alſo of this opinion is increaſed by Hiſtories: For many women report that ſome haue beene cut out of their mothers womb after they were dead and ſo ſaued, as *Scipio* and *Manilius*. The Ciuill Lawyers doe condemne him as a murtherer that ſhall bury a woman great with childe before he hath taken the Infant from her, becauſe togither with the dead mother he ſeemeth, or his held in conſtruction, to haue buried a liuing Infant; which Law being made with the conſent of Phyſitians, doeth ſufficiently declare that the Infant may

Hiſtories of many cut out of their mothers wombs.

ſuruiue

ſuruiue after the Mother is dead.

It is reported that *Gorgias* the Epirote, after his Mother was dead and vppon the Beere to be buried, yſſued aliue from her wombe, which could not haue beene vnleſſe the heart of the infant had had in it a vitall faculty, which without the aſsiſtance and communion of the mothers heart for a while did ſuſtaine his life.

But I thinke it will not be hard to giue a ſufficient anſwere to all theſe authorities and arguments. For *Galens* authority we make the leſſe account of it, becauſe it contradicteth himſelf. Moreouer we ſay that the experiment which *Galen* biddeth vstry is impoſsible, for you cannot intercept the vmbilicall veine and arteries of the infant vnleſſe the Mother bee dead and her wombe opened, and then we ſay the infant doth reſpire not tranſpire. And whereas they ſay that the heart hath not wherewith it may be refrigerated vnleſſe it be moued. VVe anſwere, that the infant contained in the priſon of the womb, hath ſufficient for the preſeruation of his life from the mothers Arteries, becauſe it liueth as thoſe creatures do, which the Grecians call φωλεύοντα ζῶα, beſide it receiueth ſome refrigeration from the lukewarme water wherein it ſwimmeth. Anſweres to the authorities and arguments.

The laſt reaſon from the cutting out of liuing Infants out of their dead Mothers, may ſeeme to ſome to vrge much, but the anſwere is at hande. That the vitall faculty diffuſed through all the arteries, without the communion of the heart may for a ſhort time preſerue the infant aliue after the Mothers death.

We haue ſeene (ſayth *Galen* in his ſecond Booke *de Placitis*) *a Sacrificed Beaſt walke after his heart was taken away, and haue often made experiment of the ſame in a Dogge.* VVhat alſo if I ſhall ſay, that thoſe Mothers were Hyſtericall and eſteemed as dead when yet they were aliue, which thing is not vnuſuall? The truth therfore of our opinion remaineth firme, that the heart and the arteries of the infant do pulſe or beate from a power proceeding from the heart and arteries of the Mother, not from any proper and ingenit faculty of their owne, & that no new Arteriall blood is generated in his left ventricle, ſeeing the Mothers Arteries do ſupply a ſufficient quantity, and that very pure. *Galen.* The Concluſion.

From hence let the Peripatetiks learne, how vnaduiſedly *Ariſtotle* calleth the heart the firſt liuer, mouer, and blood-maker. For both the Arteries of the infant do moue before his heart, and the heart liueth onely by the pulſation of the Arteries. Finally, as long as the infant is included in the wombe of his mother, we do not beleeue that his heart is the Shop or Store houſe either of vitall ſpirits, or of Ateriall blood. Againſt the Peripatetiks principality of the heart.

QVEST. XXVIII. *Whether there be in the infant any generation of Animal ſpirits, and what poſition the Infant hath in the womb.*

THE mouing Faculty floweth into the fleſh of the Muſcles from the brain by the Nerues, not by a ſimple irradiation or ſeparated quality, but by a Corporeall ſubſtance, which the Phyſitians call *Animalem ſpiritum*, an *Animal ſpirit*. Seeing then the Infant in the wombe mooueth of his own accord ſometimes to the right ſide, ſometimes to the left, and oftentimes kicketh with his heeles, it followeth neceſſarily that he hath alſo Animall ſpirits. But whether he draweth theſe from his Mothers wombe as he doth the vitall, or generateth them in the *ſinus* or ſubſtance of the braine by a proper and inbred faculty, it hath of long time beene a great queſtion. I thinke that they are generated in the braine, and my reaſons are theſe. Becauſe there is no Communion or connexion betweene the Nerues of the wombe and of the infant, as there is betweene their Veines and Arteries. Now onely the Nerues conuey the Animall ſpirits. The generation of the Animall ſpirits in the infant.

You will Obiect, that the Animall ſpirit ſtandeth in neede of aer for his conſeruation & expurgation, but no aer is inſpirated as long as the infant is in the Mothers wombe. I anſwere; that this Animall ſpirit is cheriſhed, purged & tempered by that tranſpiration which is made by the vmbilicall arteries, but his generation we thinke to be the ſame in the womb that is after the infant is borne, which how it is we ſhal declare more at large in the ſeuenth Booke where we ſhall of purpoſe entreate of it. Obiection. Solution.

Concerning the time of the infantes motion, *Hippocrates* ſeemeth not alwaies of one minde. For in his Booke *de Morbis mulierum* he ſaith, that male children moue the third moneth, and females the fourth; but in the third Section of his ſecond Booke *Epidemion* he ſaith, the infant is mooued the ſeuentith day in theſe words, *Whatſoeuer is mooued the ſeuenth day is perfected in the Triplicities*. And in his Booke *de Nutritione*, *thirty dayes forme the* In the time of the infantes motion *Hippo.* varrieth.

infant,

The places reconciled.

infant, 70 *mooueth it*, *and* 210. *perfect it*. You may reconcile *Hippocrates* to himselfe in my opinion, if you say, that there is one motion obscure, another so manifest that the eye may iudge of it and the hand may feele it if it be laide vpon the belly. In 70. dayes the Infant may mooue but the motion shall be neyther visible nor to bee felt till after the thirde or fourth month. And surely my selfe haue knowne a woman in three children confidentlie auouch, that after 8. or 9. weekes she hath alwayes felt her infant mooue very sensibly, which I could not beleeue, till I had well considered of this place in *Hippocrates*.

That the Infant may mooue at viii. weekes.

Concerning the position of the infant, Different placesreconciled

Concerning the position also or scituation of the infant in the wombe, which is referred to the mouuing Faculty, there are some places which neede to be reconciled. *Hippocrates* in his Booke *De Natura pueri* saith, that in the womb the infants head is neere vnto his feet. *Thou canst not iudge* (saith he) *though thou shouldst see an infant in the womb, whether his head be placed aboue or below*. But in his Booke *de Octimestri partu* hee writeth, that the head is placed in the vpper part of the wombe in these words, *All Infants are begotten hauing their heads vpward*. *Aristotle* in the 8. chapter of his 7. Booke *De Natura Animalium* seemeth to reconcile these places on this manner; *All creatures* (saith hee) *in the first months after their Conformation beare their heads vpward, but when they encrease and grow toward their byrth, their heads bend downward*.

A diuers reading in *Hippo.*

Againe, in *Hippocrates* Booke *De Natura pueri* almost all Copies haue it thus. *The Infant seated in the wombe hath his hands at his cheekes*, yet all interpreters translate it *ad Genua at the knees*. I thinke that both readings may be maintained; for there are some Copyes of both readings. For the Infant hath his hands at his cheekes and at his knees. The palmes of his hands take hold on his knees, and the backes of his hand touch his cheekes. For, if as *Aristotle* writeth in the place next before quoted, the infant is so rowled vp that his nose is betwixt his knees, his eyes vppon his knees, his eares on either side his knees, and that with his hands he take hold of his knees, he must necessarily rest both his cheekes vpon his hands. Those things some haue written of the different scituation of Males and Females, are but deuices of their owne braine. But those things which *Aristotle* hath written in his seauenth Booke *De Natura Animalium* concerning the different scituation of diuerse creatures, are well woorth the obseruation and our knowledge; Notwithstanding, I do not thinke fit to transcribe them heere, but referre him that desireth satisfaction vnto *Aristotle* himselfe.

How both readings are made good.

And thus much shall be sufficient to haue spoken of the infant all the while he is conteyned and contenteth himselfe with the prison of the wombe; it remaineth now in the last place, that we speake of the birth of the infant.

QVEST. XXIX. *Of the Nature and Differences of the birth.*

WE now enter into a vast Sea, a huge and enorme Tract when wee vndertake to dispute of the Nature, Times and Causes of the birth of Man; wherein wee shall meete with many contrary gusts of opinions, many vnpassable and thorny wayes. How many reciprocall waues in the concertations of the Ancients? how many quick sands in the accounts of months and dayes? howe many rockes in the search after the causes of things? amongst which vnlesse a man bee well steared by reason, he must needs set vpon some misaduenture? Notwithstanding, so necessary and profitable a voyage this is, as we will aduenture our selues; the Pole we are guided by is fixed truth, and the Pilote shall be *Hippocrates*, who as saith *Macrobius*, *Coulde neuer deceiue or be deceiued*: out of his Bookes *De Septimestri & Octimestri partu*, *De Natura pueri*, *De Principijs*, *de Alimento*, and *De Morbis mulierum*, will we draw our demonstrations.

Three heads of the questiō.

But that we may proceed in order through the whol course of our disputation, that the capacities of such as are not throughly grounded may not be confounded, we will diuide our discourse into three heads. In the first, we will open vnto you the Nature of the Birth and all the differences of the same. In the second, wee will handle the Times of the Birth by a computation of the yeares, the months, and the dayes. In the last place, wee will manifest the Causes of the varieties of the Birth, as well the Generall as the Particular, the Naturall, the Physicall, the Arithmeticall, the Geometricall and the Astrologiall Causes.

What a byrth is.

To begin therefore with the first. The Birth, which the Græcians call τόκος, we define to be an Edition or bringing into the world of an infant perfected and absolued in the womb: so that whatsoeuer month, day, or houre, the infant arriueth into the worlde, that arriuall

may

may properly and truely be called the birth. To this perfection wee ſpeake of, there is required not onely a dearticulation of the parts, for then if a woman ſhould miſcarry at foure moneths that miſcarriage ſhould be called a Birth; but alſo their ſtrength & growth, which becauſe the Infant attayneth not before the ſeauenth moneth, we cannot properly call it a Birth before the ſeauenth moneth, but either an abortment or a miſcarrying. An abortment the Grecians call by diuerſe names, ἀποφθορὰν, ἄμβλωσιν, διαφθορὰν, ἔκλρωσμὸν, ἔκβελον, ἔκλρωμα, κύημα ἀνεμαῖον. VVe therefore define an abortment to be Either the iſſuing of an imperfect Infant or his extinction and death in the wombe. Some there are who will not haue it called an abortment before the infant hath moued, ſo that a woman ſhall not bee ſayed to abort but from the third moneth to the ſeauenth, and that before the motion it ſhall be called an effluxion or miſcariage.

What is required to a perfect birth.

The names of an abortment

The definitiō

The error of ſome.

But theſe men ſeeme to me not to conceiue *Hippocrates* meaning aright: for *Hippocrates* after the *Embryo* is formed vſeth to cal it an abortment if it come before the due time, whether it be before the motion of the Infant or after it. As in the 44. Aphoriſme of the firſt Section, *Thoſe women that are too much extenuated doe abort at two moneths*: and in the Aphoriſme following in the ſame Section, *Thoſe that are naturally diſpoſed, doe abort at three moneths*. But if the Geniture be auoyded before conformation, then is it not properly called an abortment, but ἔκχυσις an *Effluxion*, ſo ſayeth *Hippocrates* in his Booke *de ſeptimeſtri partu*, *Thoſe corruptions which happen a few dayes after the Conception, are called effluxions not abortments*. *Ariſtotle* alſo in the fourth Chapter of his ſeauenth Booke *de Natura Animalium*, calleth thoſe corruptions which fall out before perfect conformation, *Effluxions*. Wherefore ſome ſay that *Hippocrates* is not to bee accuſed of impiety or of breach of his oath, becauſe hee counſelled the dauncing Dame hee calleth *Pſaltria* to prouoke an abortment, becauſe ſhe loſt not an Infant, but ſuffered onely an effluxion ſeauen dayes after ſhee had conceiued.

Hippocrates.

What an effluxion is.

Hippocrates ill excuſed.

But howſoeuer we in Schooles may diſtinguiſh thus nicely, yet God iudgeth after another manner as we may perceiue by his iudgement vpon *Onan*. Neither do we by abortment onely vnderſtand an excluſion of an imperfect Infant, but we ſay that a woman may abort in her wombe though the *Embryo* be not brought away: ſo ſayeth *Hippocrates* in his firſt Booke *de morbis mulierum*: *When a woman aborteth and the Infant is not excluded*. So that abortment ſignifieth not onely an excluſion of the Infant before the due time, but alſo the extinction or death of the ſame in the wombe before the due time of birth. For an Infant may be carried in the wombe after he is dead many yeares, as may bee proued by many examples. Among the reſt that is notable, of the Infant which the mother bare in her body 28. yeares which was turned into a ſtone, as it is recorded by *Iohannes Alboſius* a learned Phyſitian. Likewiſe that about Newarke not many yeares ſince, which after it dyed in the mothers wombe remayned there a good ſpace, and after was vomited vp by peece-meale out of the ſtomacke: a Story paſt all beleefe ſauing that it hath ſo many eye-witneſſes yet liuing and ready to iuſtifie the trueth of it. Thus we ſee out of *Hippocrates* what is a *Birth*, what an *Abortment*, and what an *Effluxion*.

His large acceptation of an abortmēt.

Two ſtrange ſtories.

Octimeſtris partus is not an abortment.

Birth is when an Infant perfected in the wombe commeth into the world whether it iſſue aliue or dead: So that they are in no ſmall error who call the Infant of eight moneths old an abortment, becauſe it is not aliue: for it is not ſimply and abſolutely of the eſſence of the birth that the Infant ſhould be borne aliue, but that it ſhould be borne perfect, now at eight moneths it is perfect. To be aliue or not aliue, to be legitimate or not ligitimate, are differences of the Birth as wee ſhall ſay by and by. An abortment is an excluſion or extinction of an vnperfect infant: an Effluxion or miſcariage is an auoyding of the geniture before perfect conformation.

Hauing thus made plaine the Nature of the birth, wee come nowe to the differences thereof. A Birth is either Naturall or not Naturall, Legitimate or Illegitimate. To a Naturall birth three things are required. The firſt, that there bee an equall contention of the infant and the mother. For the action of the birth is common both to the infant and the mother. But to which of theſe we ought to attribute the beginning of the motion, whether to the wombe or to the infant, *Galen* expoundeth in his Commentarie vppon the 37. Aphoriſme of the fift Section, *The Infant bringeth to the mother the beginning of the birth*. For being become larger and hotter and needing more ſtore of Aliment and ſpirite, with often and violent motions of his hands and feete hee breaketh the membranes. And the wombe ouerburdned with ſo great a waight and ſo vnruly an inmate, deſiring to lay down her

The differences of the birth.

The firſt condition required in a naturall birth.

her vnwealdy burden, wholly contracteth it selfe to the shutting out of the infant. So that from an equall contention of the infant and the wombe, the birth proceedeth *κατὰ φύσιν, according to Nature.* But if neither of them endeuour, or but one of them fayle, then is the birth *not Naturall.* For if all the worke lye vpon the hand of the mother, then is the byrth hard and laborious: now that hapneth when the infant is weake, or his strength spent, or he be dead; which *Hippocrates* expresseth in these words, in his first Booke *de morbis mulierum. The birth is then most difficult when the Infant issueth either dead or apoplecticall*, that is, depriued of motion and sence.

The 2. condition,

The second condition of the Naturall birth is, that it come foorth in that figure which is according to Nature. This figure *Hippocrates* first of all men described in his first Book *de morbis mulierum*, and in his Bookes *de Natura pueri*, and *de Octimestri partu. The Childe commeth with his head forward if he come according to Nature.*

A description of the natural figure.

Nowe why this figure and forme of issuing is according to Nature, *Hippocrates* rendreth a reason. *Because the Infant hanging vpon the Nauel as a ballance vpon a beame, his vpper parts are the heauier*, and therfore his head turneth sooner downward. Adde hereto that if the infant come with his head forward, the rest of his parts being flexible like waxe doe not hinder the birth but yeelde and giue way vnto it. But if he come with his feete forward, his armes may be so spred and extended that they may hinder the rest of the body. And this is *Hippocrates* opinion in his Book *de Octimestri partu. The flexible parts of the Infant are no hinderance vnto him if he issue with his head forward, but if he come with his feete forward, then they stop the passage.*

Why the head forward is the most naturall figure.

That this figure, of the head forward, is the most Naturall & safe way for the infant, *Pliny* confirmeth in the 8. Chapter of his seauenth Booke *de Naturali Historia. The olde custome is sayeth hee that dead folk are carried to their graues with their feet forward, because death is contrary to life.* As therefore a man commeth into the world with his head first, so being dead hee must be carried out of the world with his feete first.

Why dead men are carried with their feet forward.

Beside this, al other figures of the Birth are to be called *not Naturall.* Now there are diuers figures of the birth *παρὰ φύσιν not Naturall*, but three especial; with their feete forward, with the side first, or double; all which *Hippocrates* expresseth in his Bookes *de morbis mulierum*, & *de Natura pueri. It is dangerous when the feete come forward, for in such a birth oftentimes the mother perisheth or the Infant, or both together.*

Diuerse vnnaturall figures of the birth.

To deprecate or auert this danger, the auntient Romanes built Alters to the two *Carmentæ*: the one of them was called *Postuerta*, the other *Prosa* of the right or wrong proceeding of the birth. And such births are commonly called *Agrippæ*, as it were *ægre partus.* So *Agrippina* sayde her sonne *Nero* came into the world with his feet forward.

Agrippæ why so called.

The 3. condition.

The third Condition of a Naturall birth is that it bee swift, easie and without any vehement *symptomes.* I call that a lawfull or legitimate birth which commeth in due time, & that illigitimate which happeneth before or after the due time. The eight moneth-birth is illigitimate, becausе it preuenteth the ninth moneth or stayeth after the seuenth month: and this is the Nature of the Birth, these are all the differencies thereof.

QVEST. XXX. *How many times there be of a Mans Birth, and what they are.*

Aristotle. The times only of mans birth vncertaine.

Aristotle that Genius and Interpreter of Nature, as he hath in all things acquitted himselfe wondrous well; so herein also he hath written excellently, that whereas Nature hath appoynted almost to all Creatures a determinate and certaine time for the bringing foorth of their young; circumscribed and constant limits of their gestation: yet to man shee hath granted a larger and freer patent for the time of his procration and gestation. House Doues do euery month bill and breede young; a Bitch whelps at foure moneths; a Mare Foales the ninth, and an Elephant the second yeare. Onely man hath diuerse times wherein he is brought foorth, the 7. 8. 9. 10. and 11. moneths. This women doe all of them confesse, whome wee ought to beleeue sayth *Hippocrates* in his Booke *de Septimestri partu*, becausе they are most skilfull in this kinde of learning.

The 7. month the first time.

This also is confirmed by the authority of *Hippocrates*, *Aristotle*, *Plutarch*, *Galen* and *Aphrodysæus*; and beside by certaine lawes of the Romanes. The seuenth month is the first limit of a mans birth, and before seauen moneths no infant suruiueth, albeit some Egyptians, the Poets of *Naxus*, and many Spaniards report that some haue beene borne aliue the sixt moneth.

The

The seuenth-moneth birth, *Hippocrates* saieth is vitall or dooth suruiue in his booke *De Principijs. The Infant borne the seuenth month is reasonably borne and liueth.* He is reasonably borne, because he wanteth nothing in the perfection of his parts; for in the two months following there is nothing added to the perfection of the parts, but vnto the perfection of his strength. The 7 month childe Vitall. *Hippocrates.*

Aristotle in his 7. booke *De Natura animalium* affirmeth the same, as also *Aphrodiseus* in his Problemes. *Galen* in his Commentary vpon *Hippocrates* booke *de Septimestri partu* saith, that he hath seene many children borne the seuenth month suruiue and do well. The same in Honor of *Hippocrates* was concluded by the Roman Lawes, and standeth in force at this day euen among our selues. *Aristotle.* *Galen.* Lawes of the Romanes.

Pliny reporteth, that *Sempronius* and *Corbulo*, two Consular Romanes, were borne of their Mother *Vestelia* the seauenth month. I haue also credibly heard it reported, that that good old man Doctor *Turner* of S. *Ellins* now lately gone to heauen, was borne the seauenth month and preserued by some small sustenance till he was able to sucke, which was about two months after he was borne. And if you obiect *Hippocrates*, who in his Booke *de Septimestri partu*, saith, that there be few seuen-month children, and of those few many perish, and therefore *Aristotle* biddeth that they should bee laide in wooll and carefullie swathed. I will giue you this answere, that there are many seauen-month birthes, because there is a great latitude of the seauenth month. *Pliny.* *D. Turner.* Obiection. Solution

Those that are borne in the beginning of the seuenth month may indeed liue, but they are exceeding weake and do not recouer strength in forty dayes, and of these we must vnderstand that place of *Hippocrates*; for he saith they are borne after 182. dayes and a part of a day, now 182. dayes do make but the beginning of the seauenth month. But those that are borne in the end of the seauenth month, that is, after 210. dayes are strong, and fewe of them perish. Of such he speaketh in his Booke *de Principijs*, where he saith; The 7. month-infants are borne according to *reason*, and do liue because they accomplish three tenths of weekes, and euery tenth fulfilleth seauenty dayes. The difference of the 7. moneth infants.

Againe, the seauenth-month infant is either a Male or a Female; A male because hee is sooner formed, mooued and perfected in the wombe, if he be borne the seauenth month he suruiueth. A Female because she keepeth not that proportion which is required to the Conformation, Motion and Birth, if she be borne the 7 month she will haue life, but not hold it long. This first rule we establish as a Law, that the seuen-month childe is legitimate and vitall, and that this is the first limit of a mans birth. The bringing foorth of a childe at 8. monthes is called, not an abortment, a birth, but yet it is neither a vital nor a legitimate birth. *Hippocrates* in his Booke *de Principijs. No Infant borne the eight month suruiueth*, and the same he repeateth in his Booke *de Octimestri partu*, and *De alimento*, elegantly indeede, but very obscurely, where he saith, *The birth of* 240. *dayes* (such is the eight-month birth) *is and is not*. As if he should say, the infant is indeede borne the 8. month, but so, that it had as good not haue bin borne, because it cannot suruiue. The 8. month infant is not Vital.

In Egypt where that fruitfull *Nylus* runnes, and in *Spaine* where women haue easy trauels, and where the heauen and the earth agree together to bee kinde to man, there manie men say, that some 8. month infants do liue. *Asclepiades* saith, that the women of *Naxus* doe bring foorth their children aliue the 8. month, and they suruiue either because *Iuno Lucina* hath giuen them this priuiledge for *Bacchus* sake, or because *Bacchus* was borne that month, after whose name it is called *Dyonisia Naxos*. But these are rare things, and beside are different from the Vniuersal Nature as the Philosophers speake. Add heereto, that in the account of the months women are often deceiued, so that they seeme to themselues to bring foorth the eight month when it is indeed the ninth; for there are some whose courses flow the second month after their conception, and such women think they haue not conceiued when indeede they haue conceyued. In Egypt som suruiue at 8. months.

Aristotle in his tenth book *de Historia Animalium* sheweth how there may many errors happen in the computation of the time of their conceptions. *There are some* (saith he) *who think that there can be no conception vnlesse both parents do at the same time eiaculate their seed.* Nowe such are deceyued; because the body that is best disposed soonest looseth, wherefore that seede being very strong is not corrupted, but beeing drawne it is reserued for that mixtion which is to be afterward. How women are deceyued in the acompt of their Conceptions.

They erre also who thinke they haue not conceyued vnlesse the wombe bee dry and all the seede be retained; because of the whole seede which proceedeth aswel from the man as from

Many women think they haue conceiued whē they haue not.

from the woman the matrix draweth first no more then it can, then no more then it should draw. Many women therefore haue conceiued which thinke they haue not conceiued, and these doe easily mistake the sixt for the seauenth, the eight for the ninth months.

The 9-month birth is most legitimate.

The nine-moneth birth is of all other the most vitall and legitimate, as that which is in the middle of the two extreames, and is beside most familiar to Nature. Concerning the ten-moneth birth *Hippocrates* hath written many things in his Bookes *de Natura pueri*, and *de septimestri partu*. *Homer Odyss.* λ maketh *Neptune* to speak thus vnto the *Nimphe*. *After a yeare is accomplished thou shalt bring forth a beautifull burthen.* That is to say the tenth moneth, for of ten moneths consisteth the yeare among the *Aeolians*, as also among the ancient Romanes, now *Homer* we know was an *Aeolian*.

The 10 mōth birth vitall.

Concerning the eleuenth-moneth birth there is great difference among authours; *Hippocrates* seemeth to haue conceiued diuersly of it; in his Booke *de Natura pueri* he determineth that the tenth moneth is the longest limit of gestation, *within ten moneths at the furthest* sayeth he *the Infant is borne*. But those women who thinke they go vnto the eleuenth month are deceiued in the number of dayes and computation of the time of their Conception, for sometime the wombe is distended with winde and breedeth a false conceit of their being with childe. Oftentimes vpon the suppression of their courses their bellies swell and they thinke they are conceiued, making their accompt from the time of that suppression.

11. month-birth controuerted.

How women are deceiued in their computation.

Aristotle vnthankfull to *Hip* his good maister.

Aristotle, who indeede tooke all that he writ concerning the Nature of Creatures onely from *Hippocrates*, and yet (vngratefull man as he is, neuer maketh mention of him) reprooueth those women who say they haue borne their children eleuen and twelue months. The beginning sayth he of Conception most women are ignorant off, especially if they couple and conceiue when before their wombes are distended with winde; for then they esteeme that they haue conceiued when their bellies beginne to be distended, whereas indeede they are first distended with winde and afterward conceiue: For *Hippocrates* determineth that the tenth month is the vtmost limit of gestation; (and *Vlpianus* the Lawyer admitteth no children to the inheritance who were borne after the tenth moneth;) but in his Booke *De septimestri* and *octimestri partu*, he acknowledgeth the 11. month.

Hippoc reconciled to himselfe.

You shall reconcile *Hippocrates* to himselfe, if you say, that the end of the tenth moneth is the absolute and longest limit of gestation, and that a woman cannot fulfill eleauen compleat moneths, but if she bring forth in the eleuenth month it is in the beginning thereof, and that is *Hippocrates* meaning when in his Booke *de octimestri partu* hee sayth, that some women carry their burthens vntill the eleuenth month, he meaneth vnto the beginning of the 11. moneth.

Auicen of a birth at 14. months.

As for the twelfth, the thirteenth and the foureteenth moneths *Massurius* reporteth that *L. Papyrius* the *Prator* awarded an inheritance of Land against an heyre whose mother confessed that she bore him after thirteene moneths; because the time of his birth seemeth to him to be litigious. *Auicen* writeth that he saw a childe borne fourteene months after Conception: but if any such thing happen, we conceiue it to bee a rare accident and beyond the consideration of Art.

Wee conclude therefore that the first limit of a mans birth is the seauenth moneth, the last is the eleuenth, the intermidiate times are the ninth and the tenth.

Months are manifold.

Now what are seuen-moneth, eight-month, nine-month, and ten-month births, and of how many dayes euery one of these consisteth, and also what account and supputation of dayes we are to make it remayneth that we should declare, for vppon this Axle-tree is the whole Controuersie rowled, this laberynth hath innumerable windings and turnings, out of which no man shall be able to redeeme himselfe who is ignorant of *Hippocrates* computation of moneths, *decades*, weeks and dayes; wherefore we will a little while stay our reader vpon the consideration of them.

Mensis solaris.

Mensis lunaris.

A Moneth according to the Astrologians is manifould, one called *Solaris* another called *Lunaris*, a third Common, that is to say, according to the *Iulian* Kalender. That is called a Solarie moneth wherein the Sunne runneth through thirty degrees of the Zodiacke, and it contayneth perpetually thirty dayes. The Lunary moneth according to *Galen* is double, the one of *Progression* the other of *Apparition*. The moneth of *Progression* he calleth that space which commeth betweene one coniunction of the Moone with the Sunne and another, and it conteyneth nine and twenty dayes and a halfe. A moneth of *Apparition* consisteth onely of 27. dayes, because three dayes are subtracted wherein the Moone lurketh

The month of progressiō

The month of Apparition.

keth as it were and giueth not her light. The Common month or the month of the Kalender doth not alwayes consist of the same number of dayes. For the month of February hath xxviii. dayes, May xxx. Iuly xxxi. And this is the variety and difference of months. Nowe what is *Hippocrates* month is very difficult to determine, some doe thinke it to be the Lunary, and the Lunary of Progression onely. And this may be warranted by the authoritie of *Hippocrates*: for in the beginning of his Book *de Septimestri partu* he writeth, that 2. months consist of nine and fifty dayes, and that fiue months are accomplished of an hundred seuen and forty dayes and a halfe. Now fiue times twenty nine, make an hundred forty fiue, wherto if you add two dayes and a halfe, the summe will amount to 147 dayes & a halfe; so that euery month shall containe nine and twenty dayes and a halfe. *Galen* in his Computation of the Criticall dayes and the dayes of Gestation, accounteth according to the Lunarie month, and in his Commentary vpon *Hippocrates* Booke *de Septimestri partu* is of opinion that no infant suruiueth after two hundred and foure daies.

The common month. What is *Hip.* month according to some.

We on the contrary do imagine that *Hippocrates* Months are Solarie consisting of thirty daies, as we gather by his owne computation. For in his Booke *de Principijs* he saith, that the seauenth-month birth hath three Denaries or *Decades* of weekes, and in euery *Decade* are 70. dayes; and that three Decades of weekes make 210. dayes.

We thinke *Hip* month to be Solary, consisting of 30. dayes Authorities to proue it.

If therefore the seuenth-month birth do accomplish two hundered and ten dayes, then euery month shall conteine thirty dayes, becaus seauen times thirty makes two hundered and ten.

Againe, in the same Booke he writeth, that a perfect birth is not accomplished till nine months and ten dayes, but nine times thirty makes two hundred and seauenty, whereto if you add ten, the sum wil amount to two hundred and eighty.

Moreouer, in his Booke *de Alimento* he writeth, that the birth at two hundred and forty dayes, (by which all men vnderstand the eight month-birth) *is and is not*: now two hundred and forty dayes make eight Solary months. Furthermore in the third Section of the second Booke *Epidemian*, *Whatsoeuer is mooued within seuenty dayes, is perfected within the triplication.* Now three times seauenty make two hundred and ten, which accomplish seuen compleate months.

Finally and most manifestly in his Booke *de Octimestri partu* he teacheth that wee must make our computation of months in the gestation of the Infant by the Solary months consisting of thirty dayes. *The New Moone* (saith he) *is one day, & the thirtith part of the month.* Two dayes make the fifteenth part of the month, and three daies a tenth; wherefore wee conclude, that the months of the birth are Solary rather then Lunary. And truly the efficacy and power of the Sun is more auaileable to generation then that of the Moone, whence it is that *Aristotle* in the second of his Physicks calleth the Sun *Stellã Salutarem* & γενεθλιον, that is a healthfull and fruitfull Starre, because it is the parent and procreatrix of al things. For *the Sun and a man do generate a man.* As for the Decads and weeks of *Hippocrates*, there is no reason we should much trouble our selues about them, for they are as cleare as the midday-sun it selfe. Euery Decade conteining seuenty daies, and euery weeke seuen.

How diuerse *Hip.* is in computation of dayes.

One scruple there remaineth to be remooued, wherewith I confesse I was a great while puzled, and that is, why the Computation of daies to make the seuenth-month birth is not one and the same: for in his Booke *de Principijs* hee saith, that the seauenth-month birth is brought into the world the two hundred and tenth day, which opinion of his, *Auicen* the Prince of the Arabians followeth. *Fen.* 21. *lib.* 21. *cap.* 2. of the generation of the *Embryo*. But in his Booke *de Septimestri partu* and in the very beginning he saith, *that the seueuth-month birth is borne within an hundred and eighty two dayes, and a part of a day*, which also he repeateth in his Booke *De Octimestri partu*, where he sayth, that the seauenth-month birth is fulfilled in halfe a yeare and a part of a day, that is to say, in a hundred eighty two daies and fifteene houres.

That *Hippoc.* Booke *de Sept. partu* is legitimate.

Some of the Interpreters, that they might auoide these snares, haue disallowed of his Booke *de Septimestri partu*, as if it were not *Hippocrates* owne, at least they boldly affirme that this place is corrupted. But wee on the other side are as confident that it is truly Hippocraticall. For not onely *Galen* Commented vpon it, a few fragments of whose labour remaine to this day, but also the Lawyers of that time when Learning did most flourish at *Rome* and *Athens* did translate this very sentence according as we at this day read it into the number of their Sanctions. Wherefore these diuers not contrary places concerning the number of dayes we will thus reconcile.

Hip. interpreted. The Latitude of the ſeauenth month is very great, neither is the ſeauenth-moneth birth alwayes brought into the world in one and the ſame day. There is a ſeauenth moneth beginning, and a ſeauenth month perfected. The Beginning conſiſteth of a hundred & eighty daies & a part; the perfection conſiſteth of two hundred & ten dayes. Before an hundred eighty two dayes no infant ſuruiueth, ſo that this is the firſt limit of the ſeauenth moneth. After two hundred and ten daies it is no more called a ſeuenth-month but an eight-month birth. The firſt births in the beginning of the ſeauenth moneth are indeede vitall yet verie languid and weake: the latter are very ſtrong. Wherefore *Hippocrates* in the places before quoted expreſſed onely the two extreame times of the ſeauenth-month birth, that is to ſay, the firſt and the laſt. The middle times he maketh no mention of, as of two hundred & foure daies, &c; becauſe they are ſufficiently knowne by the nature of that extreame vnto which they approach the neereſt. And this is not my interpretation of *Hippocrates*, but *Hippocrates* owne. For, as in his Booke *de Octimeſtri partu* he calleth thoſe *Decimeſtres* not onely who accompliſh ten whole months, but alſo that reach a few dayes within the tenth month: So thoſe are called *Septimeſtres*, who beſide ſix full months do attaine ſome dayes of the ſeauenth. And yet more plainly in his Book *de Alimento* after he hath deſcribed the *Septimeſtres*, *Octimeſters*, *Nonimeſtres*, and *Decimeſtres partus*, at length he breaketh out into theſe words, *In theſe months are begotten or rather breede more and fewer according vnto the whole and the parts*, that is, either in a part of the moneth, or in the whole and full moneth. And in his Booke *de Septimeſtri partu* he ſaith, that the fiue months which come betweene the firſt and the ſeuenth muſt be numbred whole: but the firſt and the ſeuenth it skilleth not much though they be imperfect.

The vtmoſt time of the ſeuen-month birth.

So in the computation of the Critical dayes, thoſe daies which go before the *Criſis* muſt be accompted whole; but the Criticall day it ſelfe wherein Nature endeauoureth the *Criſis* hath a great latitude; for a *Criſis* yea a happy and proſperous one, may fal out in the beginning, in the middeſt, or in the end of the ſeauenth or the fourteenth daies: wherefore thoſe months which go before the birth, muſt be al accompted whol excepting the firſt. Againe, the very month of the birth which is of the ſame nature for accompt with the Criticall day, hath two extreames and many intermediate times. In any of which if the infant be borne he may ſuruiue. And thus I thinke you may cleare your ſelfe out of the Thornie and intricate paſſages of months and dayes in the Computation of the legitimate or illegitimate times of the birth.

The intermediate daies & months are onely perfect.

QVEST. XXXI. *What are the vniuerſall and particular Cauſes of the Birth.*

Democritus. *The Septickes.* *Ariſtotle.* *Hippocrates.* *Heraclitus.*

Emocritus a great Philoſopher of his time, complaineth that the truth is drowned in a deepe well. The *Pyrronij* or Scepticke Philoſophers thinke that all things are vncertaine and that nothing can be determinately knowne. *Ariſtotle* the Father of the Schoole of Philoſophers ſaith, that the certaine and Naturall cauſes of all things naturall are onely knowne to Philoſophers; which before Philoſophy it ſelfe was borne our admired maiſter *Hippocrates*, in his Booke *de Aere aquis, & locis* hath thus expreſſed, ὐδὲν ἄνω φύσιος γίνεται, *Nothing in Nature is done vvithout Nature*, that is, without a naturall cauſe. Theſe cauſes if any man with *Heraclitus* ſhal deny, he ſhall not onely entangle himſelfe in a thouſand Labyrinths of abſurdities, but alſo forfeite all knowledge and aſſured demonſtration; for to know, ſaith the Philoſopher, is to vnderſtand the Cauſes of things; Seeing therefore the birth is a naturall action, and that the times therof are very different, it ſhal not be amiſſe a little in this place to enlarge our ſelues in the diſquiſition of the cauſes thereof.

The vniuerſal cauſes of the birth.

The Cauſes therefore of the birth are ſome of them vniuerſall, others particular. The vniuerſall cauſes are common not onely to man but alſo to al creatures; and ſome of them are on the part of the birth; others on the part of the Matrix or woombe; becauſe the byrth proceedeth from an equall contention of the birth, and the bearer. The Cauſe on the part of the birth *Hippocrates* in his Booke *de Natura pueri*, elegantly expreſſeth to be the defect of both ſorts of aliment: Spirituous and Solid on this manner; *When the Infant becommeth larger and ſtronger, the Mother cannot ſupply it with fit and ſufficient Aliment, which while it ſeeketh with often kicking it breaketh the Membranes, and being vnlooſed from thoſe bandes yſſueth foorth.*

On the part of the infant.

The Mola or Moone calfe may be carried in the womb many yeares, becauſe it is neither

ther nouriſhed nor doth tranſpire; wherefore deſiring neither Aliment nor ayre, it is ſtil retayned. There are ingendred oftentimes in the wombes of women, Monſters and Creatures of diuers kindes, as Serpents and Mould-warps which becauſe they haue little bloud haue alſo little heate and being contented with tranſpiration alone doe lurke many yeares in the corners of the wombe, neither would euer iſſue of their owne accorde vnleſſe they were driuen forth either by the contention of the wombe or by the helpe of the Phyſitian. The want therefore of nouriſhment is the firſt cauſe of the birth.

Why the *Mola* and many monſters lie long in the womb.

There is alſo another vniuerſall cauſe on the part of the wombe: for the wombe hauing a determinate quantity & magnitude beyond which it cannot be extended, when once vpon the increaſe of the Infant it is come to that extent, it laboureth to lay downe the burthen wherby it is oppreſſed: and according hereto *Hippocrates* ſaith in his firſt book *de morbis mulierum* that abortments do happen when the wombe is too little, that is, when the Infant is ſo encreaſed that it can be no longer contayned in the wombe. *The wombe* ſaith hee *hath peculiar diſpoſitions bred with it which cauſe abortment*, and among thoſe diſpoſitions he accounteth the narrowneſſe thereof: wherefore the Infant ſeeking nouriſhment and the wombe not admitting further diſtention, do make the birth.

The vniuerſal cauſe of the birth on the part of the wombe. *Hippocrates.*

The particular cauſes doe belong onely to the birth of a man, becauſe man onely among all creatures hath the times and ſpaces of geſtation and birth very diuerſe and different, of which differences the cauſes alſo are as different. Firſt it is manifeſt that all bruite beaſtes are at certaine times prouoked to Generation: as therefore the times of their coition are certaine: ſo alſo are the times wherein they bring foorth; mankinde becauſe at all times and ſeaſons hee is fitte for Generation, doeth at all ſeaſons alſo bring foorth his burthen.

The particular cauſes of the birth.

Now the limits of geſtation and birth of the Infant are manifold and diuers; not on the part of the vniuerſall agent, that is of Nature; for the power of Nature is the ſame in man and in beaſt; the motion one and one eſtabliſhed Law: but the variety comes from the diuerſity of matter, which in a man vndergoeth manifould alterations more then in a beaſt: for bruite beaſtes vſe alwayes the ſame ſimple dyet, a man doth not onely vary in the matter but in the times of his repaſt. The other creatures after they haue conceiued will no more admit the Male, which is not ſo with a woman, whence comes no ſmall alteration in the body of the Infant. The other creatures are not tranſported with paſsions, which how hurtfull they are vnto men euery man hath too much experience in himſelfe and *Plato* in *Charmide* elegantly recorded, writing That all the miſchiefes that happen to mens bodies proceed from the affections of the minde.

The diuerſity is from the matter.

The 1. cauſe

The ſecond.

The third. *Plato.*

Some there are who referre the cauſes of the variety of the birth to the different Nature of the ſeede, ſome ripening ſooner ſome later. To theſe we will adde the ſingular prouidence of Nature for the conſeruation of mankinde, which is the Final cauſe: For being more carefull of man (whome *Pliny* calleth Natures darling) then of bruite beaſtes, ſhee hath granted vnto him more times and limits both of geſtation and birth. The times of of birth are the 7.8.9.10. and eleuenth monethes: but why the ſeuenth and ninth moneths are vital, that is, why children ſuruiue who are borne in thoſe moneths and not in the eight this indeed is hard to be knowne.

The fourth.

The fift.

Why the infant ſuruiueth at 7. months and not at 8.

The opinion of the *Pythagorians.*

The *Pythagorians*, *Geomitricians*, *Aſtrologians*, and *Phiſitians* are of diuerſe minds concerning this matter, and becauſe it is an elegant controuerſie and full of variety wee will take liberty in this place to diſcuſſe them all.

The *Pythagorians* and *Arethmetitians* referre all thinges to number; for they make and ordaine a threefould order in things; of *formes*, *figures* and *numbers*, among which, *numbers* are the chiefe: for in the whole Scripture wee reade that all things are diſpoſed in number, waigth and meaſure.

Differences of numbers.

Of Numbers ſome are equall ſome are vnequall; the equal numbers they call fœminine, the vnequall maſculine; the firſt imperfect, diuiſible and vnfruitfull; the latter perfect, fruitfull and indiuiſible; and therfore ſay they theſe numbers haue the nature of a principle; for the equall number is generated of two vnequals; but an equall neuer generateth an vnequall. Furthermore among the vnequall numbers the ſeauenth hath the firſt place, whoſe maieſty and diuinitie is ſo great, that the antients tearmed it ſacred and venerable. The *Magi* of the *Indians* and the wiſe Prieſts of the *Egyptians* called the ſeuenth, the number of the greater and the leſſer world.

The excellency of the number of 7.

Phylo the Iew in his Booke *de mundi opificio* attributeth this prerogatiue to the ſeuenth

that it alone can neither generate nor bee generated: of other numbers which are within tenne, some doe generate but are not generated as the number of one or the vnity; some are begoten but doe not beget as the number of eight; some both beget and are begotten as the number of foure: only seuen neither begetteth nor is begotten, and hence commeth the perfection and dignity thereof; for whatsoeuer neither begetteth nor is begotten that remayneth vnmouable. Againe, the *Pythagorians* call the septenary number the tye or knotte of mans life, which *Tully* in *Scipio* his dreame acknowledgeth, where he sayth, *That seauen is the knot of all things.*

Hatmony.

There is also in this number most harmony, as being the fountain of a pleasant *Diagramma*, because it contayneth all the harmonies, *Diatesseron*, *Diapente*, *Diapason*; as also all proportions Arithmeticall, Geometricall and Musicall.

What the diuines say of the number seauen.

The Diuines call it the number of *Perfection*, because all things were perfected the seuenth day. The number of *Rest*, because the seauenth day God rested from all his workes. The number of *Sanctification*, because it was commaunded to bee sanctified or kept holy. Finally, the number of *Reuenge*, of *Repentance* and of *Beatitude*: whence it was that the Poet sayde, *ô terque, quaterque beati, O thrice and foure times happy.*

Phylo Iudæus and *Linus* an old Poet haue written many things in the commendation of this number of seauen. To omit that which some haue obserued, that there are seauen wonders of the world, seauen wise men among the auntients, seauen greater and lesser Triones in heauen, seauen circles wherewith the heauens is ingirt, seauen wandring starres, seuen starres in the Beare, seauen starres of the *Pleiades*, seauen changes of the voyce, seauen physicall and naturall motions, seuen vowels among the Greekes, seauen ages; that the seauenth age shall be a golden age, seauen mouthes of *Nilus*, seauen mettalles, seauen liberall Arts, seauen windowes in the head, seauen causes of all humaine actions, seauen Cities that stroue for *Homer*, that the seauenth Sonne is able to cure the Kings Euill, and a seuenth Daughter if she be present quickeneth a womans trauell, the hearbe Tormentill which hath seauen leaues resisteth all poysons. All these things I say we wittingly and willingly passe ouer, for it must bee confessed that vnder the name of numbers there are many friuolous and superstitious toyes thrust vppon the world: I come to Philosophicall and Physicall demonstrations.

It is to bee marked that the Physitians and Philosophers haue obserued how our life is dispensed by seauens.

The life of man cõsisteth of seauens.

Hippocrates in his Booke *de principiis*, sayeth that *the age of Man* consisteth of the septenarie number of dayes: For many of them who in seauen dayes space doe neuer eate nor drinke, doe dye one of those dayes, aswell because the Gut called *Ieiunum* is contracted, as also because the stomack in so long cessation of his office becommeth forgetfull afterward to do his duty.

The Seede of the man which within seauen houres after eiaculation returneth not backe, wee may bouldly pronounce is Conceiued: so the seauenth day after Conception, the first rudiments of all the spermaticall partes doe appeare, and the Geniture sayth *Hippocrates hath the seuenth day whatsoeuer the body ought to haue.*

The seauenth-moneth birthes are vitall not the eight, and the seauenth day after the birth the Infant casts the remaynder of his Nauell: after twice seauen dayes hee beginnes to mooue his eyes towardes the light, after seauen times seauen hee is able to mooue his head and eyes euery way. The seauenth moneth hee beginnes to breede his teeth, after twice seauen hee is able to sit without feare of falling, after thrice seauen hee beginnes to speake, after foure times seauen to goe, and after fiue times seauen to leaue sucking.

The seauenth yeare hee changeth his teeth, their third Generation beeing then made of most solide Aliments as *Hippocrates* writeth in his Booke *de principiis*; at that time also his speech growes perfect, whence the Grecians doe make seauen vowelles. After twice seauen yeares the signes of youth beginne to breake out, in maydens the courses flowe, breastes swell, and they are fitte for husbands. In men the voyce changeth, and they grow petulant by reason of the vigour of their naturall heate. After thrice seauen yeares they grow towards their strength which remayneth constant the fourth, fift and the sixt seuens, and that age is called *virilis* and *constans ætas*, that is, *Man-hood*. The seauenth septenarie is called *Quadratus*, because then a man is euery way accomplished both in bodye and in mind.

The

The ninth is esteemed Clymacterical and very dangerous, for it hath beene alwayes obserued (as *Aulus Gellius* noteth) that this time of a mans life is for the most part accompanied with some notable danger of the life, or greefe of the mind. And therefore we read in the same Author, that *Augustus Cæsar* congratulateth his Nephewe *Caius* concerning this Climacterical yeare on this manner. *All hayle my pleasant Nephew Caius, whom beleeue me, I do alwayes desire when thou art absent from me, but especially at such times as these my eyes do euen faile with looking for my Caius, yet whersoeuer thou art this day I hope that with good health and good cheare thou doest celebrate this my 64. birth-day. For as thou seest wee haue ouercome the 63. yeare, the common Clymacterical and dangerous yeare for old men.*

Auguſt Cæſar to Caius.

The tenth Septenary which fulfilleth the seauentith yeare, is esteemed to be the limit of life, and so the Kingly Prophet singeth in the Psalme, *The dayes of a man are seauenty yeares, beyond which all is labor and sorrow.* Wherefore all Septinary dayes and moneths and yeares are especially to bee considered, because in them there happen notable mutations.

Psal. 90, 10.

Hence it is that *Ficinus* the Platonist giueth him Counsell that desireth to prolong his life, euery seuenth yeare to take counsell of an Astrologian and a Physitian. Of the Astrologian, that he may vnderstand what dangers and where do hang ouer his head; and of a Physitian, that by a prescript rule of dyet he may auoide the threatnings of the Starres and their maleficall influence.

Aristotle in his seauenth Booke *De Historia Animalium* doth also acknowledge this prerogatiue of the number of seauen, because in euery Septinary the greatest changes do vse to happen. *Galen* deliuering the precepts of health, maketh the distinction of Ages according to seauens. It is not therefore without good warrant, that the *Pythagorians* call the septinary number the beginning or principle of all things. *Tully* the tye or knot of all thinges; and Physitians warranted by certaine experience, the King or prince of the Decretorie or Criticall dayes. Wherefore the Pythagorians and Arithmetitians do therefore conclude, that the seauen-month birth is vitall because it consisteth of an vnequall and most perfect number.

Pythagoras and *Tully.*

And this *Hippocrates* in his Booke *De Principijs* doth also acknowledge, for therefore hee thinketh that Infants borne the seauenth-month do suruiue, because they haue attayned a iust and full number of seauens. And that the eight-month birth is not Vital, because it hath not fulfilled the full Decades of weekes. Moreouer in his Booke *de Septim. partu* he writeth, that the Conceptions, Abortments and Births of Infants are iudged, as wee speake, in the same times in which diseases haue their iudgement or Crisis. Now we know that all diseases are most whot iudged on vnequall dayes, and that the Septinary number is onely truly Criticall.

Hippocrates acknowledgeth the power of the septinary number.

If it be obiected, that the tenth month although it be equall and fœminine is yet for the birth Vitall and legitimate the Pythagorians will make answere, that ten is the perfection of all Numbers and conteineth in it selfe all numbers of perfection. And this is the opinion of the Pythagorians and Arithmetitians of the causes of the seauen-moneth and eight-month birthes, who conceite that all things are to bee referred vnto the force of Numbers.

That the 10. number is perfect.

For my owne part I thinke with *Aristotle* in his Metaphysickes, that Number of it selfe hath no operatiue power, for so it is a quanrity; but the nature of Number as it is the form of time concludiug all the workes of Nature hath a strong efficacy. And this Nature & necessity as it were of Nature it selfe, *Hippocrates* in the end of his Book *De principijs* promiseth to explaine.

What wee thinke of Nũbers.

The Astrologians and Figure-flingers do referre the causes of the seuenth-month, eight-month, and nine-month births to the diuerse Aspects of the Planets, for ouer euery moneth they thinke each Planet hath predominance. *Saturne* ouer the first, who with his coldnes & drought reteyneth the liquid and moyst seed, and congealeth it as it were into a conception. Ouer the second *Iupiter*, who by his warmth and Vitall heat causeth it to increase. Ouer the thirde *Mars*, who with his heate and drought maketh the members beginne to mooue. Ouer the fourth the *Sun*, who by the power of his woonderfull heate enlargeth all the passages. Ouer the fift *Venus*, who addeth grace and beauty to the infant. Ouer the sixt *Mercury*, who polisheth & absolueth the Organs of motion. Ouer the seuenth the Moon, who filleth the empty spaces and distances of the Fibres with flesh & fat, and with hir moysture relaxeth the orifice of the wombe that the birth may be the more easie. If therefore the infant do the seauenth-moneth yssue furnished with all these endowments of the Pla-

The opinion of the Astrologians.
Saturne.
Iupiter.
Mars
Sol.
Venus.
Mercury.
Luna.

nets, then is he Vital and is likely to suruiue; but if being weak he be not able to looſen him ſelfe from the ſides of the wombe, then *Saturne* that maleficall Planet and aduerſarie to the principles of our life, returneth againe vppon him and ſo like a Tyrant holdeth the Infant priſoner; or if in that month he come into the world he preſently periſheth, as hauing his Vitall heate nipped by the cold of that churliſh Planet. Add heereto, that the weake infant is not able to beare or endure ſo ſuddeh an alteration from the Moone to Saturne, as if it were from the loweſt ſtaffe to the top of the Ladder, becauſe all ſudden mutations are enemies to Nature.

But if he ouercome the eight month, then to Saturne ſucceedeth Iupiter that benefical Planet, by whoſe proſperous and healthfull aſpect all the ill diſpoſition that came by Saturne is fruſtrated and auoyded; wherefore the ninth moneth the infant is borne vitall and liuely, as alſo the tenth and the eleauenth, becauſe of the familiarity of Mars and Sol with the Principles of our life. And this is the opinion of the Aſtrologers concerning the Cauſes of our birth, which is indeed elegant and maketh a faire ſhewe but is in the meane time full of Error as *Picus Mirandu'a* hath prooued in a Booke which he hath written againſt Aſtrologers. For how may it be, that Saturne ſhould alwayes beare ſway the firſt and the 8. months, when as a women may conceiue in anie months of the yeare any day in the month or any houre in the day? Why do Hindes calue the eight month and their yong ſuruine, as *Ariſtotle* writeth in his ſixt Booke *De Natura Animalium*. *Pliny* is of opinion in the fifte chapter of his ſeuenth Book *De Naturali Hiſtoria*. That only thoſe children are Vital if they be borne the ſeauenth month, who were conceyued the day before or after the Full of the Moone, or in the New Moone. But all theſe are idle and addle immaginations of vvanton braines.

The opinion of the Aſtrologians confuted.

Pliny his idle opinion.

The Geometricians referre the Cauſes of the birth vnto the proportion of the Conformation and motion of the Infant. For (ſay they) there is a double proportion of the conformation to the motion, and a trebble proportion of the motion to the birth, which proportion if the Infant holde, then ſhall hee arriue aliue and liuely into the worlde. So the ſeauenth month birth is vitall, becauſe it is formed the fiue and thirtith, mooued the ſeuentith, and borne the two hundred and tenth day.

The Geometritians proportions

And this opinion may be confirmed by the authority of *Hippocrates*, for in the third Section of his ſecond Book *Epidemiõ* he ſaith: *whatſoeuer is mooued in the ſeuentith day is perfected in the triplicities*. But *Auicen* confuteth this opinion. For if onely the proportion betwixt the conformation and the motion of the infant were the cauſe that he ſuruiueth, then ſhould he aſwell ſuruiue the eight as the ſeuenth moneth, becauſe they keepe the ſame proportion. For inſtance; Say that an infant be formed the fortith day, then ſhall hee mooue the eightith, and be borne the two hundred and fortith. And in this birth the proportion is exquiſitly held, becauſe twice forty make eighty, and thrice eighty two hundred and fortie dayes. Now *Hippocrates* in his Booke *De Alimento* ſaith, that an infant borne at 240. daies (which all men vnderſtand to be the eight-month birth) *is and is not*. But the authority of *Hippocrates* may well ſtand with this opinion, for it is not his meaning that this proportion is the cauſe of the life of the infant, but ſimply and abſolutely hee ſayth, that there is a certaine proportion betwixt the conformation, Motion and Birth of the infant, which no man will deny.

Hip. authority *Auicen.*

Hip. explained

It remaineth now, that wee acquaint you with the Philoſophers and Phyſitians reaſons why the ſeuenth-month birth is Vitall and not the eight? Nature although ſhe be illiterate and vntaught, yet hath ſhe conſtant Lawes which her ſelfe hath impoſed vppon her ſelfe; definite alſo and limited motions which ſhe alwayes keepeth without inconſtancy or mutability, vnleſſe ſhe be hindred by ſome internall or externall principle. As therefore ſhee neuer endeauoureth any perfect Criticall euacuation vnleſſe the humor bee before boyled and prepared: So ſhe neuer vndertaketh a Legitimate birth till the infant bee perfected and abſolued in all his numbers. And as in crudity no good Criſis is to be hoped for according to *Hippocrates*: ſo before the infant be perfected, the birth cannot bee ligitimate or Vitall. For the birth ſaith *Galen* is a kinde of Criſis. Now before the ſeuenth moneth the infant is not perfected, and therefore before the ſeauenth month he cannot be borne aliue. But the ſeauen-month if he be ſtrong he breaketh the Membranes, maketh way for himſelfe and ſuruiueth becauſe he is perfect, eſpecially if it be a male child.

The 5. opinion of the Phyloſophers and Phyſitians.

The Lawes of of Nature are certaine.

No vital birth before perfection

The eight month birth why not vital. 1. Reaſon.

The eight month although he be perfect hee cannot ſuruiue, becauſe hee is not able to beare two afflictions, one immediately ſucceeding in the necke of another. For in the ſe-

uenth

uenth moneth he laboreth sore,and repeateth his contention the eight,before his strength is refreshed.

And this is *Hippocrates* opinion in the very beginning of his Booke *de octimestri partu*, *Concerning the eight-moneth birth I am of this iudgement, that it is impossible that the Infant should beare two succeeding afflictions,and therefore those Infants doe not suruiue.* For they are twice afflicted,because to the euils they suffered in the wombe are added also the payne in the birth. Hippocrates authority.

Again,the eight-month birth is not vital,because it commeth after the birth day,which should haue beene the seauenth moneth,and before the birth day which is to bee the ninth moneth. Whence we may gather that some ill accident hath betided the Infant or the mother which hindred the birth the 7. month and preuented the ninth. The 2. reason

And hitherto belongeth that golden sentence of our admired maister *Hippocrates* in the eight Section of his sixt Booke *Epidemion*. *If nothing happen within the prescript time of the birth,whatsoeuer is borne shall suruiue.*

But now why a woman doth not beare her burthen beyond the tenth and the eleauenth months. *Hippocrates* in his Booke *de Natura pueri* referreth the cause to the want of Aliment. Now the Aliment fayleth as well because a great part of the bloud flowes back vnto the Pappes for the generation of Milke,as also because the Infant is nourished only with pure and sweete bloud which the mother can no longer in sufficient quantity supply vnto him. Neither is that to bee passed ouer with silence which *Hippocrates* obserued in the Booke before named ,to wit,that in some women the Aliment fayleth sooner, in some later. Those which are not accustomed to bring foorth haue lesse Aliment then others for their Infants, because the bloud is not accustomed to turne his course toward the wombe. Againe,those women who haue lesse store of their courses and of Milke their Aliment faileth the sooneſt. Why a woman goeth not aboue 11. moneths. What women defraud their Infants sooneſt.

It is also worth our obseruation that large and great creatures do carry their burthens the longest, because they doe not so soone attaine the perfection of their increment or growth: So an Elephant bringeth not forth before the second yeare after her conception, but house-doues breed euery month. Why great creatures carry their yong long.

Man being of all Creatures the most perfect, the most wise,the most temperate and as it were the measure of all others,hath also moderate times of gestation, that is, the 7. and the 9. months if Nature be not interrupted or preuented.

QVEST. XXXII. *Whether in a desperate byrth the Cæsarian Section be to be attempted.*

ARistotle in his seauenth Booke *de Natura Animalium*, sayeth that among all creatures a womans trauell is most laborious and difficult,as wel because she leadeth a soft and sedentary life, as for that a mans Brain is the largest and so his head great,especially as long as he is in his mothers womb;now th ehead vseth to come forward in the birth. This birth as sayeth *Galen* in the eight Chapter of his fifteenth Booke *de vsu partium*, exceedeth all admiration;for the mouth or orifice of the wombe, which all the time of the gestation is so closed that a needles poynt cannot passe into it;in the birth is so enlarged that the Infant yssueth out thererat. Why the birth of man is most difficult. A miracle of Nature in the birth.

But there are many obstacles which intercept the passage of the Infant by the orifice and necke of the wombe;as the thickneſſe and magnitude of the Infant, or naturall straytneſſe of the inward orifice and of the neck;a distortion,inflamation,some tumor against nature, a fleshy Caruncle,a scarre,or the faulty confirmation of the share-bones. For oftentimes in the inner part of the share-bone there is a sharp processe which intercludeth the passage of the Infant vnto the birth blace,and then there is no hope that the woman can be deliuered: Wherefore either the Infant must perish or the mother,or both together. In this so hard and desperate an extremity, the question is what may be attempted? wee answere. If the mother be dead and the childe yet liuing, then presently without any delay the wombe of the mother must be ript open. And those children that are thus taken foorth are called *Cæsares*, or *Cæsones* from the cutting of the mothers wombe, from whence the *Cæsars* had their names. After this manner as *Pliny* reporteth in the ninth Chapter of the seauenth Booke of his Naturall History, was *Scipio Affricanus* the elder, *Iulius Cæsar* and *Manilius* borne. What things hinder the outgate of the infant. The wombe must be presently opned if the mother be dead.

But if the mother be yet aliue and the Infant by no other meanes can safely bee brought forth

Though the mother liue, yet this ſection may be attempted. *Hippocrates. Paulus.*

foorth the ſame ſection or opening of the wombe may bee adminiſtred; for common experience and the authority of antient Phyſitians doe aſſure vs that the wounds of the muſcles of the lower belly and of the *Peritonæum* or rim are not mortall.

Hippocrates in the third Section of his ſixt booke *Epidemiõ*, commaundeth vs to cutte our Dropſie patients inſtantly: now this Section for the Dropſie is a wounding of the *Epigaſtrium* or lower belly and the *Peritonæum*: as for the wombe it ſelfe *Paulus Aegineta* teacheth vs that the wounds thereof are not mortall. *It appeareth vnto vs* ſaith he *that though the whole Matrix bee taken away, the woman will ordinarily ſuruiue.*

Franciſcus. Roſſet.

Concerning this *Cæſarian* ſection, *Franciſcus Roſſetus* the French Kings Phyſitian hath ſet foorth an elegant Booke ſo beautified with Hiſtories and abounding with good arguments, that wee ſhould abuſe our time and your patience to tranſcribe them in this place: wherefore wee remitte thoſe who deſire further ſatisfaction heerein to that learned Authour.

QVEST. XXXIII. *Whether in the Birth the Share and Haunch-bones doe part aſunder.*

The wonderfull indeuour of nature in the birth.

THE workes of Nature in the conformation, life and nouriſhment of the Infant are indeede full of admiration, but her laſt endeuour in the birth thereof is indeede the crowne of all the reſt, as that which exceedeth all admiration. For the orifice of the wombe which after the firſt apprehenſion and conception of the ſeede was ſo exquiſitely cloſed that it will not admit the point of a Probe: now that the Infant with turning, kicking and breaking of the membranes prepareth toward his enlargement, it is ſo relaxed as if it were a gate wide open.

But becauſe Nature is ſo wiſe and prouident that ſhee vndertaketh nothing without due preparation, therefore in the laſt moneths of geſtation ſhe lyneth the inner ſurface of the orifice with a ſlimy and mucous humor, which thereupon becomming moyſt and ſoft doth more eaſily diſtend or inlarge it ſelfe without feare of laceration or tearing.

Now whereas the wombe is contayned within the capacity of the hanch-bones, and is walled about on the fore-ſide with the ſhare-bones, on the backe-ſide with the holy and rump-bones, and on either ſide with the hanches, whereof ſome are ioyned together with a faſt and immouable articulation, other by the mediation of a cartilage or griſtle: whether in the birth there bee a diuulſion or ſeparation of theſe bones, that now is the queſtion we haue in hand.

That the bones are parted in the birth. Authorities. *Hippocrates.*

Some learned men are of opinion that the ſhare-bones and the haunch-bones are ſeuered, which alſo may bee confirmed by the authorities of many right learned men and by reaſons which carry with them a faire ſhew of trueth. *Hippocrates* in the end of his Booke *de Natura pueri* wrote on this manner. *In the very birth the whole body is as it were vppon the racke, but eſpecially the loynes and the hanches, for their Coxendices are diſtracted and parted aſunder.* And *Auicen* in his third Booke *Fen.* 21. *Tract.* 1. *Cap.* 2. ſayeth. *When the Infant is borne the wombe is opened with ſuch an apertion as cannot be made in any other place, and it is neceſſary that ſome iunctures muſt be ſeparated, which are ſo ſuſtayned by the helpe of God ſo diſpoſing and preparing, and afterward doe returne to their naturall continuation; and this action of all the workes of Nature is the ſtrongeſt and moſt forcible.* *Rabbi Zoar* vppon the firſt of Exodus. *Thou ſhalt not eaſily finde any thing in the whole adminiſtration of Nature more to be admyred then that diſtraction of the ſhare-bones in womens trauell, which indeed is done by the prouidence of God to whom Nature is but a ſeruiceable hand-mayd, for otherwyſe no ſtrength almoſt is able to ſeperate them. The like alſo we haue ſeene in the ſhooting of Stagges hornes which euery yeare fall and grow againe.*

Auicen. *Rab. Zoar.*

Pinæus opinió His firſt reaſon.

Seuerinus Pinæus in his Phyſiologicall & Anatomicall work is of the ſame opinion, which alſo he ſtrengtheneth by ſome reaſons. Before the ſeuenth moneth, ſayth he, the wombe and with it the Infant doth alwayes aſcend; after the ſeauenth moneth hee deſcendeth and prepareth himſelfe toward his enlargement. At that time the priuities of the woman with childe are moyſtned with a mucous ſlime, and the parts are dilated and relaxed, with which humour alſo by degrees the griſtles of the ſhare-bones are inebriated, that in the birth they might bee the more laxe. Furthermore almoſt all the griſtles of the body in progreſſe of time doe dry into a bony ſubſtance as may be ſeene in the chinne; but the cartilage which tyeth together the ſhare-bones remayneth griſtlely to the end of our life, neither euer becommeth bony, becauſe in the birth it is to be diſtended and enlarged. Moreouer if you

The ſecond.

The third.

well

well consider virgins of 16. or 18. yeares old, and againe take notice of them after they haue conceiued, thou shalt perceiue that their hanches are distended, their *Hypogastrium* enlarged and their buttockes become broader, especially when they are neere the time of theyr deliuerance: and therefore it followeth that those partes are dilated. Moreouer, those who haue liued long virgins haue harder trauels then yonger wenches, because their gristles in those places are more dried and lesse relaxed. The fourth.

Finally, such as neuer haue conceiued haue thinner gristles, and such as haue oftenest conceiued haue them most thicke and are broadest in the hanches. Wherefore in the birth the share-bones are parted assunder one from another, and the hanch-bones from the *Os Sacrum* or holy-bone. And for the confirmation of this his opinion, he telleth a Story of a woman who was new deliuered and shortly after hanged, whose share-bones were so distracted that one of the *Coxæ* was lifted vp and the other depressed. The fift. A history.

For my owne part that I may freely speake what I thinke, I do not think that these bones in the birth can be vnioynted, for they are so fast knit together that no violence can seuer them. And if they bee separated asunder how shall they be againe coupled? with what Cement or Glue shall they be vnited? For a new Synchondrosis or articulation by the mediation of a Cartilage cannot be made. If you say with *Hippocrates* that they chinke a little, I will not be against it. Also that the gristly end of the Holy bone, which they call *Coccyx* or the rumpe, may be totally retracted and so giue way to the infant that there should bee a greater space left for his out-gate, that I can well beleeue. As for *Pinæus* arguments they may thus be in order answered. It is indeede said and saide truly, that in the last months of Gestation the inner orifice of the wombe is lined with a slimy humor, proceeding eyther from the vterine vessels, or from the humours sweating through the Membranes, or otherwise from the reliques of the infant; but that humor say we cannot attaine vnto the Share-bones or to the Cartilages betweene, them neither yet vnto the hanch-bones; because the womb doth not imediately touch the share-bones; for betwixt the wombe and the bones lyeth the bladder lurking betweene the two coats of the *Peritonæum* and compassed round about with the *Peritonæum* as it were with a purse or Sachell. Our opinion that the bones cannot be seuered. *Pinæus* Arguments answered. To the first.

And whereas he saith, that the Cartilage which knitteth together the Share-bones neuer becommeth bony but alwayes remaineth gristly that it might bee relaxed in the birth; it is but a slight reason; for neither in men is that gristle euer found to be bony. In young wenches after they haue conceiued, their hanches are distended and the capacity becommeth larger, and that because at that time all the parts of their bodies do grow & the heate which before was well neere choaked with the aboundance of humors beginneth to shine foorth and gather strength. Elder Maidens hauing conceyued haue harder trauelles then yonger, not because the gristles are drier but because their wombs are drier; for those that vse to conceiue and beare children haue moister wombes, larger vessels and all the capacities more large and ample and therefore their trauell is more easie. One History dooth nothing mooue vs, for we haue seene many who haue perished in the very brunt of their trauell in whom there hath appeared no such matter, and we obserue that women in their trauels do more complaine of the paine of their *Os sacrum* and rump, then of the region of the share-bones. To the second. To the third. To the fourth To the fift.

And thus are we come to an end of our long Discourse of the History of the Infant and the Controuersies thereto belonging, wherein how we haue acquitted our selues it resteth in thee gentle Reader to iudge; this one thing wee know, that wee haue wrought out our way through many difficulties, which if they shall prooue as profitable and pleasant vnto thee as they haue beene to vs difficult to ouercome, wee haue aboundant recompence.

Now we proceede in our entended iourney to the Chest, wherein what Admirarable rarieties Nature hath bestowed, we referre thee to our Discourse to be satisfied.

The End of the History of the Infant, and of the Controuersies thereto belonging.

THE SIXT BOOKE,

Of the Middle Region, called the Cheſt or the Thorax, which conteyneth the Vitall partes to *to which alſo wee will referre the Necke with the Weazon.*

The Præface.

HAuing thus abſolued the Lower Region with the parts thereof as wel Nutritiue as Generatiue, togither with the hiſtory of the Infant; it followeth that we aſcend by the ſtaires of the ridge to the middle Bellie, wherein as in a curious Cabinet Nature hath locked vp the vitall Inſtruments and wheeles whereby the Watch of our life is perpetuallie mooued from the firſt houre to the laſt minute by ſo iuſt a counterpoiſe as no Art of man could euer attaine vnto, albeit ſome rare Enginers haue gone very farre in imitation thereof. If we ſhould enter into the cauſes of this perpetual motion, as it would be very hard to find them out, ſo would it ſpend much time to enquire after them. The higheſt cauſe is the hande of God, who hath prepared the Pullies, hung on the weights and gouernes and winds vp the Chime at his own good pleaſure. For if the Philoſopher were not able (though he were nere of councell to Nature) to diſcerne with the ſharp edge of his incomparable capacity the reaſon of the reciprocal ebbing and flowing of the Sea: how ſhall we be able to yeelde a reaſon of the Dilatation and Contraction of the Heart. Notwithſtanding it is commonly conceyued that the moſt immediate cauſe is the auoiding of Vacuity that Arch-enemy of Nature. For the Faculty of pulſation although it be potientially in the heart of the infant in the Mothers wombe, yet it is not drawne into acte till the Cheſt diſtending it ſelfe doth draw in the aire wherof that Vitall ſpirit is made, about whoſe generation that Pulſatiue vertue is wholly occupyed. As for the motion of the Arteries, we conceiue that they follow the motion of the heart, like as a Lute lying by another that is played vpon, will repreſent or returne the diſtinct Tune thereof.

I might heere enter into a large diſcourſe of the excellency of the Heart; how in this Litle world, it is like the Sun in the Great world; how it continually ſupplieth the expence of Vitall ſpirits; how it quickneth and ſtrengthneth the Naturall heate of the whole body; how it is an Embleme of an excellent Magiſtrate; how the Lungs as freſh Fannes do temper the flaming heate of the hearts furnace, and how as Bellowes they kindle the ſame againe. For albeit this Sun of the body can neuer be truly ecclipſed, this Genial fire neuer extinguiſhed without the diſſolution of the *indiuiduum*; yet we ſee in many cold diſeaſes of the braine & malignant exhalations from the wombe, that to our ſenſe this ſparke of Sacred fire is deaded and put out, which notwithſtanding by the helpe of the Lungues is afterward blowne vp into a luculent flame.

Beſide the Organs of life, there belongeth alſo to this Region another no leſſe admirable inſtrument of Nature, whereby the voice is ſo diuerſified, that vpon the ground therof that Noble Science of Muſicke hath beene from the beginning and ſtill is infinitely propagated and yet the end or perfection thereof not attained vnto. But why do I go about in this place to exemplifie the adminiſtrations of Nature in this middle Region? conſidering that to ſay a little is derogatory from the woorth of the argument; to ſay much were heere in vaine, ſeeing the following Diſcourſe is purpoſely addreſſed for the Readers ſatisfaction therein.

CHAP.

CHAP. I.

Of the Thorax or Cheſt, and the Diuiſion of it.

THE middle belly is called θώραξ, of a word which ſignifieth to leap or dance, becauſe in it the heart continually mooueth from the ingate to the outgate of life. It is comprehended by the ribs, or rather circumſcribed by the Ribs and Patell bones, and is ſeparated from the lower Belly by the Midriffe or *Diaphragma*, and it is the ſeate or conceptacle of the vitall Faculty which harboureth eſpecially in the heart, for whoſe ſake this Cheſt or *Thorax* was made; the habitation of the breathing partes, and the ſhop wherein the voice is framed; and for this cauſe it is called of *Hippocrates* χέλυς *teſtudo*, a Citterne or Crowd, becauſe the ſound of it maketh Muſick. It is placed between the vpper and lower bellies, that the Natiue heate which reſideth in the Heart may bee equally communicated to all the parts.

The Cheſt. How it is limited.

The cheſt was made for the heart.

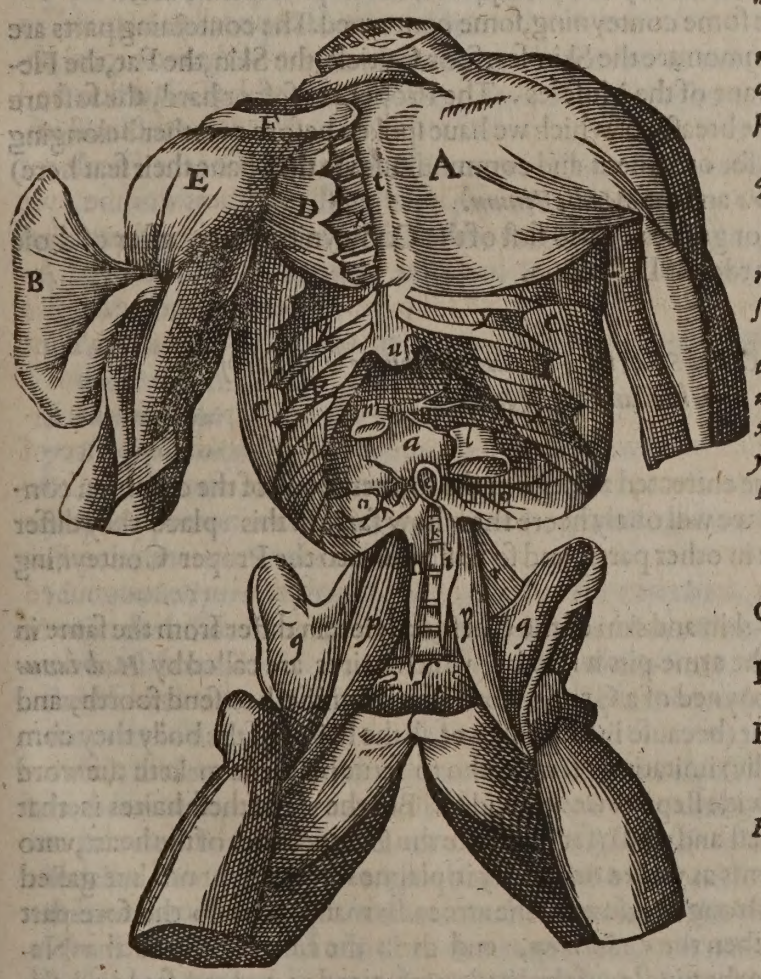
Compared to a Crowd.

The Figure of it is very capacious, being long & round like an Egge, whoſe magnitude may be gueſſed by the compaſſe it carrieth without. Before and behinde it is wider in man (ſaith *Ariſtotle* 2. *Hiſt. Anim.* 1.) then in other creatures; before, that there might be ſufficient ſpace for the Heart and Lungs to mooue and ſpred themſelues in, both for the voyce

The Figure of it.

Table 1. *ſheweth the body when all the bowels are taken out of the Lower Belly, and reclined backeward, that the Scituation of the Midriffe might better be diſcerned, it ſheweth alſo the other part of the Cheſt as yet couered.*

TABVLA I.



a The Midriffe in his ſeate.
e the hole of the great Artery cut open.
h, *i*. Two fleſhy originals of the Midriffe.
k. The diuiſion of the Midriffe wher it tranſmitteth the Artery.
l. The leſte perforation of the Midriffe giuing way to the gullet.
m. the hole of the Midriffe through vvhich the hollow veine aſcendeth.
n. The veine called *Phrenica*.
o. the Artery called *Phrenica*.
pp. the ſixt paire of Muſcles of the thigh called ψόας.
qq. the ſeauenth paire of Muſcles of the thigh, which fil the cauity of the hanch-bones.
r The fift Muſcle of the backe.
ſ the Holy-bone, together with ſom nerues ariſing out of the marrow thereof.
t The breſt bone.
u The breſt-blade.
xx the ribs.
yy the intercoſtall Muſcles.
A B. the pectorall Muſcle, or the firſt Muſcle of the arme in his proper ſeate at A, the ſame ſeparated as farre as his implantation at B.
C C. the Muſcle called *Serratus maior*, or the ſecond Muſcle of the Cheſt.
D. *Serratus minor*, or the firſt Muſcle of the Shoulder blade.
E. the Muſcle called *Deltois* or *Epomis*, the ſecond Muſcle of the arme his originall is at *t*.
F. The *Clauicula* or Coller bone.

and

and for reſpiration ſaith *Galen* in the 6. chap. of his 13. Booke *de vſu partium*, that we might haue abundance of ſpirits; for that in it the ſprightfull blood is laboured of blood and aer, and the voice alſo is to be formed of the aer. Behinde it is wide, that a man may ly at eaſe vpon his backe; in other creatures it is faſhioned like the Keele of a Shippe; betwixt their fore feete in foure-footed Beaſts for their better footmanſhip; in Birdes for the nimbler motion of their wings when they flye. If it had beene otherwiſe framed in men (ſaith *Galen* in the 11. chapter of his 13. Booke *de vſu partium*) it would haue hindred the actions of their armes and in Beaſts it would not haue ſuffered their fore-bowes to haue beene ſo cloſe brought to their cheſt, which would haue hindred them much in their gate.

The ſubſtãce and ſtructure

The ſubſtance of it is neyther altogether bony as the ſcull is, for then it could not haue beene mooued, nor altogether fleſhy as the Lower belly, for then the Muſcles would haue falne vpon the heart and the Lungs euen of their owne accord: wherefore that both there might be a ſpace within for the motion, and alſo al the whole frame of the inſtrument might be mooued together, the Muſcles and the bones are ſet as it were by courſes one beſide another. For becauſe the heart, one of the principall bowels, was to be ſeated in this Cheſt, it needed a more ſafe and ſecure muniment or defence, and therefore it is walled about with bones: but becauſe the exceeding great heate of the heart ſtoode in neede of much colde aer, by which as by a fan it might be ventilated and preſerued, it was neceſſary that the cheſt ſhould be moueable, that in the dilatation of it aer being drawn into the Lungs might refreſh the heart, and in the contraction the ſooty vapors might bee expelled. Wherefore it was neceſſary that it ſhould be compoſed of many bones, which becauſe they ſhould mutually follow the motion one of another; it was requiſite alſo that they ſhould bee ioyned togither with ſome pliable ſubſtance, ſuch as is a Cartilage or griſtle.

The Reaſons of it.

The Cheſt therfore is moued with Muſcles & made vp and compacted with bones, & therefore is rightly called the Middle venter, not onely becauſe of his ſcituation, but alſo by reaſon of his ſubſtance, neither wholy bony as the heade, nor wholy fleſhy as the lower Venter.

How rightly called the Middle belly.

The whole *Thorax* or Cheſt is diuided inro a fore-part, which is called στῆθος or στέρνον *pectus*, commonly the breſt; the ſide parts called πλευρὰ, *Latera* the Sides; and the back part called ῥᾶχις or μετάφρενον, *Dorſum* the Backe, all which appeare in this precedent Table.

The Diuiſion of the Cheſt.

The parts of this Cheſt are ſome conteyning, ſome conteyned. The conteining parts are common or proper, the Common are the Skin-ſcarfe or Cuticle, the Skin, the Fat, the Fleſhy pannicle, and the Membrane of the Muſcles. The Proper are ſoft or hard, the ſoft are fleſhy, as the Muſcles (and the breaſts, of which we haue ſpoken before as rather belonging to the lower Venter, though for ornament and commodious vſe they haue their ſeat here) or Membranous, as the *Pleura* and the *Mediaſtinum*.

The parts of it.

The hard parts are bones or griſtles. And firſt of the Conteyning parts, after of thoſe conteined, according to the order of Diſſection.

CHAP. II. *Of the Skin, the Fat, and the skinne veſſelles of the Cheſt and the Necke.*

How the cõmõ inueſting parts differ from the ſame in other parts

BEcauſe we haue entreated at large in the former Booke of the common conteyning parts, we will onely heere ſhew how farre in this place they differ from the ſame in other parts, and ſo paſſe on vnto the Proper Conteyning parts.

The Haires of the arme pits.

The Scarfe-skin and skin of the Cheſt, do heerein differ from the ſame in the Lower belly, becauſe in the arme-pits it is hairy, which haires are called by *Hadrianus Iunius*, *Grandebalæ*, I thinke coyned of a Greeke word which ſignifieth to ſend foorth, and a Latine which ſignifieth great (becauſe in ſome men of all the haires of the body they com out the greateſt and moſt briſlie) imitating *Plautus*, who to ſerue his turne maketh the word *Grandegro*, to ſtalke on with wide ſteps of *Grande* and *eo*.

Their vſe.

But the vſe of theſe haires is, that thoſe parts which ſweate ſooneſt and moſt (for heere are the Emunctories of the heart, vnto which it ſendeth his excrements as we ſee ordinarily in plague ſores) might not bee galled or fretted with the often and ſtrong motions of the armes. In many men alſo the fore-part of their Cheſt is more hairy then the *Abdomen*, and as in the Lower belly is the Nauell, ſo in this middle belly are the nipples of the breſts perforated as we haue ſaide in both ſexes.

The

The fat in this place is not ſo plentifull as in the belly (excepting the breaſtes) leaſt with his waight it ſhould hinder reſpiration. The fat.

Betwixt the fleſhy membrane and the skinne runne certaine veſſels called *Skin-veines*, ſome by the ſides of the necke and the head from the two outward iugular veines, which with their ſurcles runne along the fore-part of the necke; others on the backe-ſide from a braunch which the ſhoulder veine called *humeraria* ſendeth vpward, others are diſperſed through the foreparts of the Cheſt, to wit, two comming from the *Axillary* veines, one of which is a branch of the *Axillary* veine the other of the *humeraria*, like as through the back are diſſeminated certaine ſmall branches from the ſame veines. The Arteries which come hither are exceeding ſmall and capillary: Finally, there are certaine nerues ſent from the nerues that lye lower vnder the muskles and the skinne, but two more notable then the reſt which meete about the teates, which are the cauſe of their ſo exquiſite ſence. The veſſels. Veines.

CHAP. III. *Of the muſcles of the middle belly and of the parts of the necke.*

THE Muſcles of the middle venter are double, for either they lye vppon the ribbes or are ſcituated betweene them, yet all of them are not made onely for the motion of the Cheſt; for albeit they ariſe from the Cheſt, yet they moue either the armes or the ſhoulder blades or the backe or elſe the Cheſt it ſelfe, and ſuch are called the *proper muſcles of the Cheſt*, & theſe muſcles are placed without or within: thoſe that are ſeated without are on the forepart or on the back-part.

On the forepart there are three on either ſide.

Muſcles on the foreſide of the cheſt.

1 *Pectoralis*, the pectorall, and it is the firſt muſcle of the arme, which is broade and large and ſeated vnder the Pappes.

2 *Serratus maior*, *the greater ſaw*, the ſecond muſcle of the Cheſt which lyeth vppon the ribbs, and to them is inſerted as it were with fingers, whence it hath the name of *the ſaw*, and occupieth eſpecially the ſide.

3 *Serratus minor*, *the leſſer ſaw*, or the firſt muſcle of the ſhoulder-blade, it is triangular, and lieth vnder the pectorall muſcle.

On the back part there are ten on either ſide.

Muſcles on the backſide of the cheſt.

1 *Cucullaris* or the *Munks-hood* the greater part of the ſecond muſcle of the *ſcapula* or ſhoulder blade.

2 A part of the third muſcle of the arme called *Latiſſimus* or the broadeſt muſcle, becauſe it taketh vp almoſt all the back-part of the lower belly.

3 *Rhomboydes*, the third muſcle of the ſhoulder-blade ſcituate vnder the *Munks-hoode*.

4 *Serratus Poſticus ſuperior*, *the vpper hinder ſaw*, or the fourth muſcle of the Cheſt lying vnder the *Rhomboides*.

5 *Serratus poſticus interior*, the *lower hinder ſaw*, or the fift muſcle of the Cheſt, ſcituated vnder the muſcle called *Latiſſimus*.

6. *Sacrolumbus*, or the ſixt of the cheſt.

7. *Longiſſimus*, the long muſcle, the 2. of the backe.

8. *Semi-ſpinatus*, the fourth muſcle of the backe.

9. *Spenij pars inferior*, the lower part of the *ſpleniũ* or of the firſt muſcle of the head placed vnder the *vpper hinder ſaw*.

10. *Complexi pars inferior*, the lower part of the *Complexus*, or the 2. muſcle of the head.

On the inſide.

On the inſide there is one triangular, the ſixt of the Cheſt; lying vnder the lower part of the breſt-bone, of which in the 19. Chapter of this Book. Thoſe muſcles that are between the ribs called *intercoſtales* we ſhall intreat of by and by, when wee haue numbred vnto you the parts of the necke.

I do in this place deſcribe the necke, becauſe the chiefe parts therein contayned belong vnto the vitall parts, as the muſcles of the voyce, the weazon, the *larynx* and ſuch like.

It is therefore called *Colum a colendo*, becauſe we vſe to adorne this part with chaines & iewelles. *Galen* called it τραχηλος becauſe of the ſharpneſſe of the bones of it. It is a middle part betweene the Cheſt and the head made for the vſe of the Cheſt and the Lungs; long that in the length of it the voice might bee better modulated or tuned, and therefore birds haue the moſt variety of tunes of any vnreaſonable creatures, but fiſhes becauſe they The necke.

haue no Lungs and ſo are mute, haue no necks, but all creatures that haue Lungs haue alſo necks. It is round becauſe of the bodies which are ſeated in it. The parts contayned in it are the iugulat veines externall and internall: the Arteries called *Catotides*, nerues of the ſixt paire and the recurrent nerues: all which are placed on the ſides, but before, the weazon called *aſpera arteria* or the ſharpe artery and the gullet called *æſophagus* of which we haue ſpoken before. The muſcles which are in the necke are many, ſome mooue the necke it ſelfe, ſome the *larynx* or throttle, ſome the bone *Hyois*, ſome the tongue, ſome the head, the lower Iaw and the ſhoulder blades. Of theſe ſome are ſcituated before ſome behinde. Behinde thoſe that follow which we will name as they lie each vpon other.

The figure. The parts contained.

Concerning the muſcles of it.

1 *Cucullaris pars ſuperior*, the vpper part of the *Munks-hoode* or the ſecond muſcle of the ſhoulder blade, deſcending from the *occipitium* or nowle of the head.
2 *Leuator*. The fourth of the ſhoulder blade ſeated more toward the ſides.
3. *Splenius*, The firſt muſcle of the head.
4. *Complexus*, The ſecond of the head.
5. *Recti maiores*, The third paire of the head.
6. *Obliqui ſuperiores*, the fift paire of the head.
7. *Obliqui inferiores*, The ſixt paire of the head
8. *Recti minores*, The fourth paire of the head which lye vnder the ſecond muſcle of the backe.
9. *Tranſuerſalis*, The third of the necke.
10. *Scalenus*, The ſecond of the neck, it lieth on the ſide from the firſt rib into the neck.
11. *Spinatus*, The fourth of the necke.

Before 3 theſe, beſide thoſe which grow to the iaw and are vnder the Chin.

1. *Quadratus ſeu Platyſma myodes*, The firſt muſcle common to the cheeks and the lips.
2. *Maſtoydes*, The ſeauenth of the head, from the pattell bone to the ſides of the head.
3. *Sternohyoidei*, The firſt paire of the bone *Hyois*, which lye vpon the wezon.
4. *Coracohyoidei*, The fourth paire of the bone *Hyois* ſeated at the ſides.
5. *Oeſophagiæi*, The third paire of the common muſcles of the *Larynx* or throttle.
6. *Longi duo*, The firſt muſcles of the neck.

But we returne vnto the Cheſt, and firſt to the *Intercoſtall* muſcles as being proper only to the Cheſt, & therefore we will here follow their diſcription more accuratly in this place.

CHAP. IIII. *Of the Muſcles betweene the Ribbes called Intercoſtales.*

The *Intercoſtal* muſcles

THe Muſcles which are wouen between the ribbes and do fill vp the diſtances between them are called μεσόπλευροι *Intercoſtales*. *Gal* in his Book *de vſu reſpirationis*, accounts them according to the eleauen ribs 22. other where thrice ſo many and two ouer, that is 68. as ſayeth *Archangelus*, but hee himſelfe reckons them 34. wee will account them 44. For becauſe there are on either ſide eleuen diſtances and in euery diſtance there are two muſcles, there are on either ſide 22. Of which ſome are externall [Table 1.yy] which are eleauen, and ſo many internall or within. Theſe are fleſhy and narrow but long, according to the proportion of the diſtances; their fibres are carried obliquely from one ribbe to another in a contrary poſition, ſo that thoſe of the inward and outward muſcles lying one vpon another doe mutually interſect themſelues in the manner of a Saint Andrewes croſſe, or this letter X. The outward of theſe muſcles or the ſuperior are carried from the lower partes of the vpper end of the ribbes to the vpper parts of the lower end of the ribbes: for they beginne in the backe part from the tranſuerſe proceſſes of the rack-bones to which the ribbes are annexed and paſſe with their fibres obliquely forward all along the bought of the ribbes to the beginning of the cartilages; (where the bony parts of the ribbes doe end) and are ioyned to the breaſt-bone; they want tendons becauſe of the narrownes of the place, neither do they reach thorough the diſtances of the griſtles.

Their number.

The interior or inward muſcles quite contrary are carried from the vpper part of the lower ends of the ribbes to the lower part of the vpper end of the ribs, but do not beginne from the proceſſes of the rack-bones, but from that part in which the ribs are bent, and run forward with their oblique aſcendent fibres, and fall vpon the diſtances of the ribbes as well where they are bony as where they are griſly, and keeping alwayes the ſame *ſeries* or courſe

of

of Fibres passe on to the very bones of the brest, yet so, that in the distances of the gristles they are lifted vp alittle to the outward face of the Distance, and so supply the places of the exterior where they are defectiue or wanting. And this is the cause why the Fibres in the distances of the gristles do appeare diuerse from those in the distances of the ribbes themselues. And if you take off these Fibres betweene the gristles, you shal finde also others vnder them of another position, which are the Fibres of the sixt Muscle of the Chest which is called the triangular Muscle.

Diuers fibres one vnder an other.

From the vndue distinction of these Fibres, some haue made 68. intercostall Muscles, when indeede they are but 44. reckoning those differing Muscles which are betwixt the bony parts of the ribs [Tab.2.fig 1,cc] from those that are betweene their gristly parts. [tab. 2.fig.1.dd] And whereas the distances of the ribs are eleuen, six of the true ribs and fiue of the bastard ribs; they think, that there are four in euery distance of the two ribs, two where they are bony, and two where they are gristly, and those internall and externall, but in euery distance of the bastard ribbes they will haue but two, one externall and another internall.

Auicen.

How *Auicen* and *Columbus* wer deceiued.

But we must further obserue, that the outwarde Muscles, by how much they arise neerer to the rack-bones, by so much the sooner do they determine in the fore-parts of the ribs; so againe the inward, by how much the later they arise from the bent of the rib, by so much do they come short of the brest-bone.

A note concerning the original & end of these Muscles,

Why they are obliquely placed and intersect themselues *Varolius* hath elegantly shewd; prouing that it was so necessary for the dilatation and constriction of the chest. For because the distance which is betweene one rib and another, was not aunswerable to the length of the Muscles required necessarily for the dilatation and constriction of the Chest; therefore they are disposed betweene the ribs not with right Fibres (& euen *Galen* intimated so much in the 23. chapter of his Booke *De Dissectione Musculorum*, but was not vnderstood, at least not obserued by the Ancients) but with oblique; and that this helpeth dilatation we may euidently see, because euery thing retcheth more being drawn obliquely, then if it be drawn right out, as Cloth, Leather and such like, which we call drawing Brace. For constriction also it is as fit, because the Muscle is contracted more or lesse according as it is greater or lesser. Wherefore, if they had had right Fibres, they must needs haue beene short and so their contraction much straightned, neither coulde they haue sufficiently bound in the Chest.

Why these Muscles are obliquely placed of necessity.

How they help dilatatiō.

How they helpe constriction.

Moreouer, because euery Muscle drawes according to the course of his Fibres, therefore least the ribs in their oblique motion should ioyn close together, the intercostal Muscles are framed double (a thing vnknowne to the Ancients) that with their contrary fibres they might intersect themselues. For when two opposite bodies do together drawe obliquely, there resulteth by their opposition one straight and direct motion.

Why these Muscles are double.

The Vse of these Muscles (as most Anatomists haue recorded) is to constringe & dilate the Chest. Of the exterior in expiration to beare down the ribs together, and so to streighten the Chest; of the interiour to distend and separate the ribs, and so to enlarge the cauity of the Chest for inspiration. But when *Galen* saith in the 15. chapter of the fift Booke *de vsu partium. That the intercostall Muscles helpe the Midriffe, that they might draw the Chest inward*, it is to be vnderstood not that they further the proper motion of the Midriffe, but that they moue the ribs inward; which is their proper function. But what kinde of motion is this? For either they bring one ribbe to another or seuer one rib from another, or they lift vp the ribs or presse them downe. The two former motions they performe not; for there is no vse of any such motions, neither can any of them of it selfe as a voluntary instrument dilate the place wherein it is, or separate one rib from another; neither can they lifte vp the ribs, for the Muscles which lift them vp are placed without the chest and haue their originall from elsewhere, and are called the proper Muscles of the Chest.

The Vse of Muscles.

Galen

How the intercostall Muscles helpe the Midriffe.

It remaineth therefore that they do presse the ribs onely, and that but lightly, that the contraction of the chest may so becom equall, being drawn down together with their contraction and the contraction of the Midriffe: and so that is made good which *Galen* saith, that they helpe the Midriffe. We may also say they help the sixt Muscle of the chest which is vnder the brest-bone. Yet we will not deny but that they confer also to dilatation, but that by accident as *Fallopius* and *Platerus* haue obserued, to wit, as they supply the place of a Ligament, and ioyne the ribs one to another. For when the lower ribs are drawne downeward and dilated by the proper Muscles of the chest; or when the vpper ribs are eleuated by their

They onelie depresse the ribs.

How they cōferre to dilatation.

proper muſcles, it is of neceſsity that the middle ribbes ſhould follow the draught, and ſo the middle diſtances in deep Inſpirations are dilated by the helpe of the intercoſtall whether as they be muſcles or as they bee ligaments; which yet they could not performe if the proper muſcles of the Cheſt were wanting: and therefore we may more properly ſay that in this caſe the intercoſtall muſcles are moued by the proper muſcles of the cheſt, then wee can ſay they moue of themſelues, though their motion is not meerely conſtrayned but begunne and as it were led the way by other muſcles; and haply ſuch a kinde of motion there is alſo betwixt the *Serratus maior* and the oblique externall muſcles of the *Abdomen*. There is another way alſo how the middle diſtances of the ribbes may bee dilated by the intercoſtall muſcles; for if on either ſide the firſt muſcle of the cheſt (which is called *ſubclauius* ſcituated betwixt the firſt rib and the patell bone or clauicle and hath oblique fibres like the intercoſtals) do draw vp the firſt ribbe, then by conſequtiõ the other diſtances vnder ſhall alſo in ſome ſort be dilated.

They are rather meued then moue.

Another way how they dilate the diſtãces of the ribs

CHAP. V. *Of the midriffe called Diaphragma.*

The Midriffe. The names and reaſons of them.

THe Midriffe called in Greeke by *Plato* διαφράγμα, of a word which ſignifieth to diſtinguiſh, becauſe it diſtinguiſheth or ſeparateth the inſtruments of nouriſhment from the inſtruments of life and reſpiration; and in Latine *ſeptum tranſuerſum* or the ouerthwart partition, becauſe running ouerthwart the bulke of the body it parteth it into two *venters* [as is manifeſt in the firſt Table.] This the Antients as *Hippoc.* in his Booke *de principiis* called φρένες. *i.* the minde, not that it hath any intelligible faculty, but becauſe of his notable ſympathy with the Brayne: for when this is affected, inſtantly the minde and all the ſences are out of order, and vpon the inflamation of it, followeth a kind of *phrenitis* or rather a continual aberratiõ of the mind, and in maydens ſometimes madneſſe it ſelfe, as *Hippocrates* ſayeth in his Booke *de iis quæ ad virgines*.

Madneſſe in maides.

It is a muſcle.

It is the 65. muſcle ſerning for reſpiration, and differs from all the muſcles of the body in excellency, ſcituation, figure and action. It is one, very great and ſtrong, common to both ſides, and as large as the capacity of the lower part of the Cheſt; as Table 1. declareth.

His ſcituation in the cauity of the body is ouerthwart & oblique [looke Table 1.[a]] and declining ſomewhat downward ouer all that vtmoſt compaſſe of the Cheſt which is limitted by the griſtles of the baſtard ribbes and the lower part of the breaſt-bone: This muſcle whileſt it is at quiet remayneth lifted vp as we ſee in dead carcaſſes, and maketh a great cauity, but when it worketh and is contracted it beareth downeward.

The frame of the Midriffe.

The midriffe riſeth with two long and fleſhy productions [table 1. and table 2. figure 2.[h i]] from the bare rack-bones of the loynes to which it adhereth very ſtrongly, & a great way together, for euery muſcle muſt haue ſomething to reſt his head vpon, and moſt commonly it both ariſeth from and is implanted into an immoueable part. The two productions at the ſides of the great Artery doe cleaue to the muſcles of the loynes [table 1.[pp]] and becomming broader by degrees doe meete at the eleuenth rack-bone of the Cheſt, and ſo make the muſcle circular or round, and it is tyed in his fleſhy circumference to the inſide of the Cheſt and the ends of the baſtard ribbes all along the twelfth ribbe at the lower part of the breaſt-bone and at the breaſt-blade [table 1.[u]] which was made for his defence; but in the middeſt it endeth into a ſtrong membranous and neruous tendon [tab. 2. figure 2.[bcd]] framed of very firme ſinewes and membranes. Now it was very neceſſary that it ſhould bee neruous in the middeſt, partly for the more ſecurity, that it might endure diuers motions without hurt, &not be endangered with payn becauſe of their violence: partly that the hollow veine [table 1. and table 2. figure 2.[m]] and the *æſophagus* or gullet [table 1. and table 2. fig. 2.[l]] which paſſe through it, might not be ſtreightned, and ſo the courſe of meate and bloud hindered. Wherefore howſoeuer this muſcle worketh, ſeeing onely his fleſhy fibres [table 2. figure 2.[f g]] are contracted or drawne together, the neruous part about thoſe veſſels is neuer conſtringed: but rather when the fibres are contracted the neruous part from the center to the circumference is diſtended, and the holes through which thoſe veſſels go wider opened. Moreouer, it is vnited to two of the muſcles of the *Abdomen*, the oblique aſcendent and the tranſuerſe, and aboue it is ſo ſtraightly ioyned to the purſe of the heart or *pericardium*, that without tearing it cannot be ſeparated from it.

The connexion of it

Why it is neruous in the midſt.

More of the Connexion.

The figure.

The figure of it is almoſt [table 2. fig. 2. ſheweth it] circular, round like a Plaice or Thornbacke, or likeſt a racket which we vſe in the Tennis-court, eſpecially if the racket be ſtraight ſtreatched, and the proceſſes are very like to the handle of the racket. His

His ſubſtance is partly [table 2. figure 2.[g]] fleſhy partly neruous [table 2. figure 2.[ab cd]] as if it were compounded of two broade circles, but ending in one part in an acute angle [table 2. fig. 2.[d]] of which the fleſhy circle is on euery ſide annexed to the cheſt [ſee the firſt table] and compaſſeth the other neruous circle which is in the center, to which as vnto a center many fibres like lines do runne from the circumference and as it were from the beginning or originall of the muſcle, which that you may rightly diſcerne, you muſt ſeparate the *Peritonæum* or rimme from the midriffe, which in Hogs may be done eaſily, but in a man and a dog not without difficulty.

The ſubſtance

The fibres of it.

It hath a double membrane one lower from the *Peritonæum*, another vpper ariſing from the *pleura* with which it is compaſſed for more ſtrength; although it haue another coat of his owne but a very thinne one, that it might bee diſtinguiſhed from all other parts by proper circumſcription. Veines it hath ariſing from the trunke of the hollow [table 1.[m] table 6.[A]] veine called *Phrenicæ* (ſometimes alſo it receiueth branches from the fatty veine called *Adipoſa*) which are accõpanied with arteries from the great artery [tab. 1.[e]] called alſo *Phrenica*; [the veines table 1.[n]. table 6.[c] the arteries table 1.[oo] table 13.[xx]] the veines carry vnto it bloud for his nouriſhment; the arteries vitall ſpirits together with the vitall faculty, & beſide by ventilation with their motion they preſerue his naturall heat.

The membranes of it.

His veines.

Arterier.

It hath two nerues [table 2. figure 1.[pp]] proceeding out of the lower rackebones or *vertebræ* of the necke made of three ſurcles on each ſide (and this is peculiar to this muſcle, for other parts vnder the patell bones or *clauicles* receiue none from the marrow of the necke) which nerues being carried through the cauity of the Cheſt are contorted or wound about the *Mediaſtinum*, & by it faſtned and ſtayed aloft leaſt they ſhould be hurt. And it was neceſſary that theſe nerues ſhould come from an vpper place, that they might more equally extẽd their action into euery part of it: wherfore they are diſſeminated through his whole ſubſtance, that they might affoorde vnto it all ſence and motion whence it is of very exquiſite ſence; and when it is iniured for the moſt part death followeth.

Sinewes.

A propriety.

Why his nerues come from aboue.

It hath two paſſages or holes, one on the right hand [table 1. and table 2. figure 2.[m]] in the middle neruous part for the aſcent of the hollow veine out of the vpper and gibbous part of the Liuer vnto the Heart; another on the left hand [table 1. and table 2. figure 2.[l]] a little backwarder & greater, through which paſſeth the *Oeſophagus* or gullet and 2. nerues vnto the ſtomacke, vnto which not withſtanding his membranes do grow and encompaſſe ſtreightly and very ſtrongly.

The paſſages

At the originall or beginning of this muſcle or midriffe betweene his productions [tab. 1. and table 2. figure [hi]] at the racke-bones, there is a diuiſion [table 1. and table 2. figure 2.[k]] reſembling a ſemicircle or halfe Moone for the deſcent of the great Artery & the veine without a peere or *non parill*; and for nerues of the ſixt payre fixed to the ribbes which are carried vnder the *pleura*; and this diuiſion imbraceth the racke-bones vpon which the great artery leaneth.

His diuiſion for the artery and the veine *non parill.*

The chiefe vſe of the Midriffe, which *Galen* found out, as appeareth in the 15. and 7. Chapters of his 5. Booke *de vſu partium*, and which dependeth eſpecially vpon her ſcituation, is that it might be the organ or inſtrument of free, gentle, and voluntary reſpiration or breathing, euen as the inſtruments of violent or deepe breathings are the 64. muſcles which are about the Cheſt exactly dilating or contracting it. For his fibres being equally retracted or drawne together, all the baſtard ribs are drawne toward the centre of the Cheſt, and ſo they draw the vtmoſt parts of the Cheſt vnto the rack-bones, and conſtringe or contract the lower part whereupon the Midriffe is lift vp, ſtreached and ſerueth for expiration. Hence it is that in a dead body it alwayes appeareth contracted and ſtreatched for the life endeth with expiration; and if the Cheſt be perforated within the ribs or Midriffe, it falleth ſtraight looſe downeward, and ſuffereth the Liuer & the ſtomack which before were ſomewhat ſuſpended, to fall. But when the fibres are looſened the Midriffe falleth; for the baſtard ribs are looſened, & the lower parts of the Cheſt, and conſequently the Lungs are dilated & ſo we draw in breath: wherfore when the Midriffe is hindred or affected, then muſt needs follow difficulty of reſpiration, as *Galen* ſaith in the 8. Chapter of his 4. Booke *de locis affectis*. This motion according to ſome authors, *Archangelus* among the reſt, is mixed of a voluntary & a naturall motion, voluntary it is but not ſimply, becauſe there is a neceſsity which vrgeth and exacteth this motion: as in reſpiration a neceſsity of cooling the hart vrgeth euen as in vnburdening the belly & making water the excrements do vrge and prouoke the *ſphincter* muſcles of the Fundament and of the Bladder.

The vſes of the midriffe.

The chiefe vſe

Of what kind the motion of the midriffe is.

The first Figure sheweth the middle Belly, the Skinne and the Muscles being cut away, the Breast-bone also is remooued and the ribbes broken, that the capacity of the Chest, the Membranes thereof and the Lungs might better be discerned.

TABVLA. II.

FIG. I

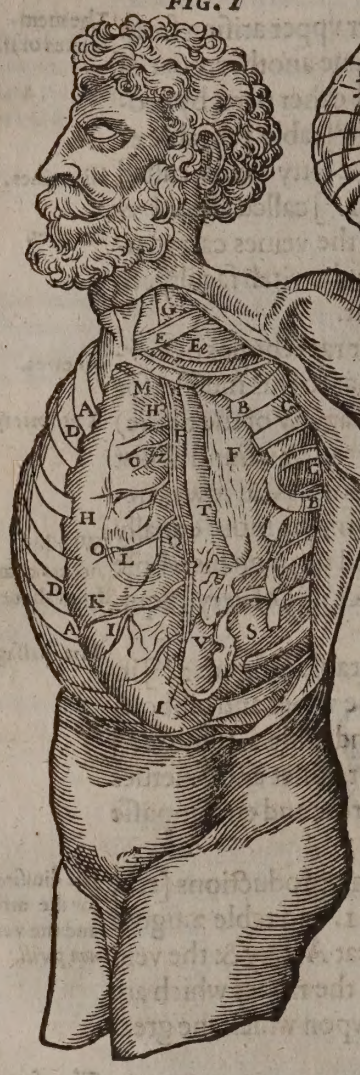


FIG. II.

A. The gristles of the ribs retracted or drawn backe.

BB. The bony part of the rib diuided from the gristle.

CCDD. The *Intercostall* muscles filling vp the distances of the bones at CC. and the distances of the gristles at DD.

E. The clauicle or coller bone discouered in his seate;

Ee. The course of the vessels running to the arme-hole.

G. The outward *Iugular* veine which shewes it selfe as soone as the skin is cut.

HH. The *Mediastinum*.

II. The surface of the midriffe.

K. The connexion of the *Mediastinum* with the midriffe.

L. A place somewhat bûching to receiue the heart.

MN. The *Mammarie* veine and artery descending vnder the breast-bone.

OO. Braunches of the vessels before named which go to the *mediastinum*.

PP. The nerues of the midriffe supported by the *mediastinum*.

Q. A veine which together with the nerue descendeth to the midriffe.

RSTV. A part of the Lungs in the left side of the cauity. R and T shew the vpper lobe, S and V the lower.

Figure II. sheweth the midriffe taken out of the body.

a. The midriffe.

b c d e. The sinewy part thereof.

f g. The fleshy part thereof.

h i. Two fleshy originals.

k. A diuision or perforation of the midriffe where through the great artery is transmitted.

l. The perforation on the left side, which giueth way to the gullet.

m. The right perforation through which the hollow veine ascendeth.

Another vse. Another vse of the midriffe is to ventilate or fanne the *Hypochondria*, especially the Liuer, because in his conuex or vpper part it wanteth Arteries to doe that office; as also the moyst vapours contayned in the capacity of the lower belly, least being at rest they should putrifie and corrupt; for which cause *Hippocrates* in his first Booke *de morbis mulierum* calleth it the breather or bellowes of the lower belly

A third vse. Another vse of it is, as *Galen* aduiseth vs in the 9. Chapter of his second Book *de motu musculorum* to helpe forward the expulsion of the excrements and the Infant in trauell by helping the muscles of the *Abdomen* as wee haue shewed in the former Booke; for which it is the more conuenient because of his oblique scituation. For aboue it presseth the guttes as it were with hands, and so driueth the excrements downward, which otherwise might as well be excluded vpward as downward if this helpe were not.

The last vse of the midriffe. *Plato*. *Aristotle*. *Plinies* conceit The last vse is, that according to *Plato*, it might deuide the *Irascible* or Angry part and faculty of the Soule from the Concupiscible & lustfull; or according to *Aristotle*, it might distinguish the naturall parts from the vitall, the ignoble from the noble, that the vapours which arise from the lower parts as from the sinke of the body, might not offend the heart the seate of life and sence as he thought. *Pliny* ascribed to it the subtility or niceneſſe of the wit, and esteemed it the seate of mirth which appeareth by tickling: for if the skinne about the *Hypochondria* be gentlely touched we are tickled and laugh presently; but more

rare

rare was that of a young man in my knowledge, who had the cauſe of an Epilepſie in his foot, which at certaine times would riſe vp and might be ſtayed by binding the legge and thigh, but when the vapor or breath came vp about the place of the Midriffe, then would he laugh extreamly and preſently after fall in his Epilepticall fit. But the Philoſophers reaſon was, becauſe the motion commeth preſently to that place; for that the skin is thin and warmeth the part, though lightly yet enough to open it, & ſo moueth the minde euen againſt the will of him that is mooued. For in the ſingle Combats of Sword-Fencers (called *Gladiatores*) at ſharpe vſuall in thoſe times, ſome haue bin ſeene to dye laughing when they haue bin thruſt through about that part.

And the reaſon why onely men of all creatures are tickliſh, is partly the thinneſſe of the skin, partly becauſe a man onely of all creatures can laugh; for titiilation is the cauſe of Laughter, when ſuch a part is mooued as from which the affection may riſe vp and fil the wings of the noſe. Another. How tickling cauſeth laughter.

CHAP. VI. *Of the Membrane called Pleura.*

THE *Pleura* is a Membrane taking his name from the Ribbes which they call πλευρὰς, becauſe it is ſtretched vnder them all, excepting the twelfe, and truely it is called a Membrane becauſe of his ſubſtance, and a coate becauſe of his Vſe. The Pleura.

It is a Membrane encloſing the whole cauity of the Cheſt, wherefore his Figure and magnitude is anſwerable to that cauity, which is Semiouall or like half an egge. His figure & magnitude. It ariſeth and is bred of ſpermaticall filaments or threds of the ſeed and the mothers blood powred betweene them after the manner of a *Parenchyma* or as the fleſh of the Liuer or other of the bowels; or it is produced from the Membranes of the Braine which inueſt the Marrow of the backe, which being brought together with ſome Nerues into the Cheſt do on both ſides frame it; wherefore there it is thicker and cleaueth ſtrongly to the rack bones or *Vertebræ* of the backe, from which vnleſſe it be broken it cannot be ſeparated, becauſe from theuce it hath his beginning of place or production. His Originall

It is tyed backward to the racke bones of the backe, which is the reaſon that ſome haue ſaid it ariſeth from their Ligaments, or from the Ligaments of the *Vertebræ* of the Cheſt as *Fallopius*; before, it is tyed to the breſt-brone; on the ſides to the Membranes of the intercoſtall Muſcles, and to the Membranes which immediately compaſſe the rib bones; aboue to the Clauicles or Patel-bones; below in his *Baſis* as *Galen* calleth it, 5. *Adminiſt. Anat.* 8. or bottome, to the Midriffe, and in the middeſt vnto the Lunges and heart-purſe or *Pericardium*. His cõnexion

His ſubſtance is like that of the *Peritonæum* or rim of the belly, but in ſtrength & thickeneſſe ſomewhat exceeding it; for becauſe it was to paſſe betweene the bonie hardneſſe of the ribs and the ſoft bodies of the Lungs, it was ordained neither too ſoft nor too hard, yet ſomewhat hard the better to defend the Vital parts; thight & cloſe wrought yet light, that the weight of it might not hinder the motion of the Cheſt, but ſtrong and neruous, harde to be diuided, and ſometimes in ſome diſeaſes of the Cheſt it hath beene obſerued by *Platerus* to grow ten fold thicker then vſually it is. His ſubſtance and ſtructure

It is all ouer double, partly becauſe of the hardneſſe of the bones, that the inner ſide which is very ſenſible might not be hurt by the continuall motion of the Lunges, partlie that betwixt both the Membranes the intercoſtall veſſels might more ſafely paſſe. It is double & why.

The one of theſe is thicker, eſpecially about the backe where it may bee cleane ſeuered from the ribs, and it is harder becauſe of the continuall motion of the Lungs and his inner face is ſmooth and ſineared ouer with moyſture, the vtter ſuperficies or face of it is vnequall and rugged. The other is thinner, and of ſome is called the Membrane compaſsing the ribs. Betweene theſe two is the matter of the Pleuriſie oftentimes collected (becauſe there are veſſels which run betweene them) and not onely betweene the Pleura and the intercoſtall Muſcles. From this Membrane ſometimes on one ſide ſometime on another, (as *Veſalius* and *Valuerda* haue well obſerued) but eſpecially on the left ſide, doe certaine ſinnowy Fibres come, by whoſe interpoſition the Lungs are ſtrongly tyed to this *Pleura* in men when they be in health, and among them is ſeene ſome ſmall portions of fat neere the rack-bones of the back where the veſſels are greater, as it is in the *Peritonæũ*; but this is but rare. And as the intercoſtall Muſcles like other Muſcles haue their proper Membrane, ſo the ribbes like other bones are compaſſed with their *Perioſtion* or proper and immediate Membrane, Where the matter of the pleuriſy lyeth

Membrane, which *Vesalius* that oculate Anatomist tooke to be one of these Membranes which we haue described.

His perforations. Aboue. Below. It is perforated where it sendeth vessels into the Chest or out of it. It sendeth out aboue the iugular and Axillary Veines, and the *Carotides* or Axillarie Arteries; but it letteth in the Gullet, the Weazon, and a Nerue of the sixt paire belonging to the Midriffe; below, it is perforated at the *Diaphragma* or Midriffe; for the ascent of the Hollow veine, and the descent of the Gullet as was saide in the former chapter; at the sides for the intercostall

At the sides. His vesselles. vessels. The vessels which are tied vnto it as they passe vnto the Neighbour partes doe lend it small braunches which come most plentifully from the Mammary and intercostall vessels. Hence it is that it is often inflamed with great tension and a pricking or gouding paine.

His vse. His vse is much like the vse of the *Peritonæum* or Rimme in the Lower belly; for as the *Peritonæum* is stretched about all the partes of the Lower belly, and affordeth vnto euerie one of them a common coate; so the *Pleura* is stretched vnder all the cauitie of the Chest, and giueth a common coate saith *Galen* to all the instruments of breathing, as also to the midriffe and the intercostall muscles and the vessels, and defendeth and knitteth them altogether. It giueth also to the vessels a safe wastage and a kinde of stability, and where it is stretched vnder the ribs, it serueth the Lunges for a defence, that they light not vppon the bare bones when they dilateth themselues in the gathering in of breth, and so be hurt with their hardnesse, and beside that the Lunges in their motion do not entangle themselues in the distances of the ribs.

CHAP. VII. *Of the Mediastinum.*

The *Mediastinum*. His Names. THE *Mediastinum* so called, because it mediateth or diuideth the Chest in the middest. *Collumbus* calleth it *Intersepimentum* and *Dissepimentum*, as a hedge that diuideth two Pastures. It is double: The right [Tab. 3.^co the right, ^ar the left] and the lefte, which *Galen* calleth ὑμένες διαφράττοντες, because they diuide the cauitie of the Chest, which the *Pleura* encompasseth into two partes. For

His scituation the cauitie of the Chest is not one open and continuall, but is diuided by these membranes. Wherefore in the middle of the chest there is one on either side which passe from aboue downeward according to his Longitude euen vnto the Midriffe, and backeward from the Breast-bone vnto the Racke-bones, so that the chest is by this meanes diuided into two circles, or if you had rather, they frame a certaine Triangle of vnequall and oblique sides, for they haue space enough to resemble this Figure: because of the deapth and length of the Breast.

His originall. These Membranes do arise from the *pleura*, which where it climbeth from his originall on either side to the sides of the breast-bone, creepeth so backe againe towardes the ridge where his beginning was, that it attaineth from the middest of the breast to the very spine of the backe. These are thinner then the *pleura*, and softer that they may more easilie follow the motion of the heart; on the outside as they looke to the Lungs (to which they sometimes grow) they are smooth, and oftentimes about the vessells they appeare interlaced with much fat, so as they may bee compared to the Kall or *Omentum*; on the inside rough, because of the Fibres with which the Membranes are ioyned, as also to the *Pericardium*; and in the hollow of the throate the *Thymus* so called (of which we shall heare afterwards) groweth vnto them. Heere, according to the length of the racke-bones of the backe vnto which they are ioyned by the mediation of the *pleura*, they euen touch together, and make but a very narrow cauity, but are after by degrees seuered and at the Breast-bone stand as wide asunder as the Brest-bone is broade, to which they cleaue euen from one end of it to

His substance

Their distace. the other; and this distance [Tab. 3.^H] is intertexed or wouen between with diuers thredy Fibres and Membranes; but they are widest asunder and make the largest distance at the *Diaphragma* or Midriffe, to which they are ioyned as far [Tab. 2. fig. 1; ^b] as his neruous part reacheth, insomuch that this cauity which is smooth and moist, before containeth the heart

Wher the distace is widest knit vp in his purse and the hollow-veine ascending vpward, and behinde the gullet with the stomacke Nerues.

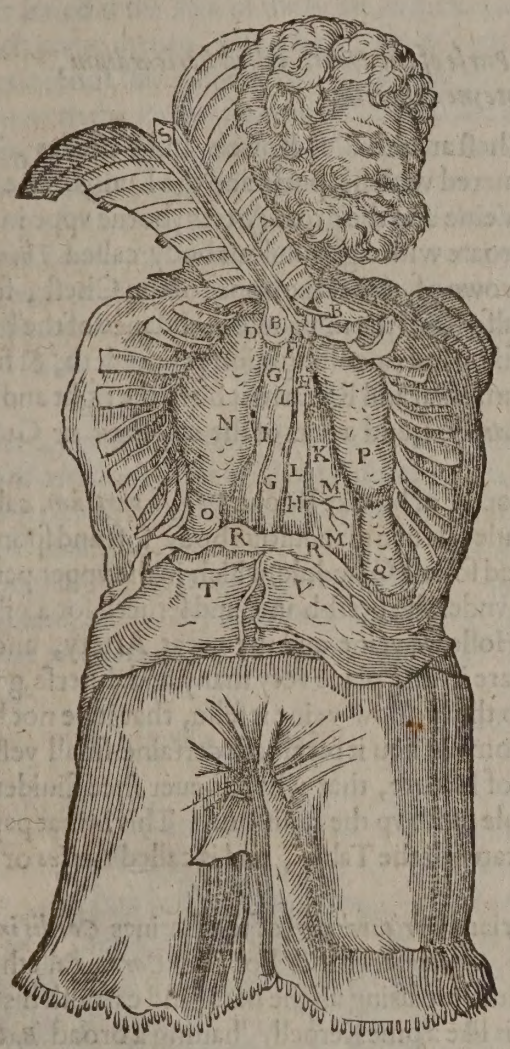
In the fore-part of this Cauity there is oftentimes a matter conteyned, which causeth a disease resembling a Pleurisie, which matter if the breast-bone (saieth *Columbus*) bee verie

A disease resembling a Pleurisie. cunninglie perforated may bee safely drawne out. In Dogges this Cauitie is more large but hath no such webbe of Fibres as in a man. The Veynes and Arteries that it hath are

very

Table 3. sheweth the middle belly before and at the sides, bared from the skinne to the Muscles, wherin also the brest-bone with the gristles of the ribs are separated from the Mediastinum *and reflected backewarde, that those thinges vvhich are conteyned in the Chest may better bee perceyued.*

TABVLA III.



AAA. The middle A. is the inside of the brest-bone; the other two shew the inside of the gristles and the ribs ioyned together.

B,C. The Mammary veines descending vnder the brest-bone vnto the right Muscles.

D,E. the *Mammary* arteries descending

F. Certaine glandules or kernels about the Coller bone, apointed to secure the distribution of the vessels.

G G,H H. The right and the left place of the *Mediastinum*, which before the diuision of it did grow vnto the brest-bone. (same

I,K. The right & left superficies of the *Mediastinu*, which is next to the lungs.

L L. The distance betwixt the Membranes of the *Mediastinum*.

M M. This swelling place sheweth the scite of the left part of the heart.

N. The vpper part of the right Lobe of the Lungs.

O. The lower part of the right Lobe of the Lungs.

P. The vpper part of the leste Lobe of the Lungs.

Q. The lower part of the leste Lobe of the Lungs.

R R. The Midriffe separated from the brest-bone, and from the tops of the gristles which cleaue vnto it.

S. The Gristle called the brest-blade.

T, V. The skin drawn downward from the foreside of the Chest.

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very small from the Mammary [Tab. 3. BCDE] which passe from the hole of the throat downward vnder the brest-bone, from which in their passage as also from the vein *Non-paril* they borrow a surcle. [Tab. 2. fig. 1. °°, from the Mammary vessels.] Moreouer in a man it receiueth a good large veine out of the hollow of the throate, which descendeth accompanyed with a Nerue [Tab. 2. fig. 1, ~] by the whol length of both the Membranes to the Midriffe, but groweth onely to their outside; sometimes also it receiueth small branches from those Vessels which we haue before named *Phrenicæ* that is the vessels of the Midriffe.

The vse of this *Mediastinū* or bound-hedge is first to hold the hart vp suspended (for being tyed to the purse of the heart it must needs do that office) lest if it had no such tye, but hung downe at liberty, in the diuerse position of the body it might fal to the sides, to the brest, to the spine, or else downward. Secondly, this serues to strengthen and secure the passage of the vessels. Moreouer, it incompasseth the parts conteyned in the Chest that they should not hurt the Lunges in his motion. And finally, it diuideth the Chest into two partes or cauities which is their chiefe profit saith *Galen* in the 3. chapter of his 6. Booke *de vsu part.* so that if one part be hurt, yet the other may be safe: as wee haue knowne a theefe Anatomized who was a strong and stout fellon, but had one side, that is, the right side of his lungs withered almost all away and dryed vp into a very small quantity, but the other remained faire and fresh as any other mans. So in wounds, if one part bee very sorely wounded, so that

The vses of this *Mediastinum.*

Their cheefe vse.

A strong and stout mā with one Lung.

that because of the entrance of the outward aer the motion of the Lungs do cease; yet the other part will not be wanting to susteine life by performing his part of the worke. For, if both parts of the Lungs be wounded any thing wide through, the voice and respiration to must needs perish: although I saw when I was a Boy a Knight wounded quite thorough the backe on both sides the bone, and so deepe that on both sides in his dressing his breath would at the mouth of the wound blow out a Candle, and yet the Patient hath perfectlye recouered. And this shall suffice to haue spoken of the Conteyning parts of the Chest, especially of those that are soft, for the hard parts which are the bones and the gristles, will fall out better to be handled afterward. Now wee will pursue our Historie vnto the partes conteyned.

S. Wilfil Euers.

CHAP. VIII. *Of the Thymus and Purse of the Heart called Pericardium, and the water conteyned therein.*

The parts conteyned in the Chest. Bowels and Vessels. veins, arteries *Thymus*. Nerues.

THE conteined parts of the Chest are double, Bowels and Vesselles. The Bowels are two, the heart couered with his purse and the Lungs. The vessels are branches of the great Veine and the great Artery, borne vppe in the hollow or lower part of the throate with a glandulous body called *Thymus*, double Nerues from the marrowe of the racke bones of the Chest, from which the intercostall nerues do come; and also from the marrow or substance of the brain conteined within the scull, from which the sixt paire or coniugation proceedeth, & from it the *Costalis* or the sinew of the ribs, the Stomachial and Recurrent both the right and the left; and finally, the Weazon called *Aspera Arteria*, and a part of the *œsophagus* or Gullet. But first of the *Thymus*.

The sixt coniugation.

The *Thymus*.

The *Thymus* which *Galen* in the fourth Chapter of his sixt Booke *De vsu partium*, calleth θυμὸν, his Interpreter, the lowest of the Glandules, is of a glandulous body, soft and spongie. (*Galen Administ. Anat.* 7, 9. cals it the great and softest Glandule) which in the vpper part of the Chest neere the hole of the throate lyeth vnder the brest-bone, and serueth for a pillow or boulster to secure all the diuisions of the Hollowe veine and the great Artery, and all the sproughts that come from them, which are in this place very many and diuerse, going to the armes and the shoulder blades; as also the Hollow-veine it selfe, that it be not hurt by the hardnesse of the brest-bone, from whome in lieu it receiueth certaine small vessels. For this is an ordinary and perpetuall worke of Nature, that whersoeuer shee diuideth a great vessell, there she interponeth a Glandule to fill vp the diuision. This is that part in Calues, which is accounted among the delicates of the Table, and is called *Lactes* or the sweete bread.

Why it is framed.

Note.

The *pericardiũ* or purse of the heart.

His Figure.

Connexions.

The Purse of the Heart, called of the Grecians *Pericardium*, of the Latines *Cordis involucrum* and *Capsula*, *Camera*, or *Aula Cordis*, *Hippocrates* in his Booke *de Corde*, calleth *Culeus*. It is a large Membrane, couering and incompassing all the hart; and carrieth his Pyramidall Figure [Tab. 4. fig. 1. D E F] or rather is like a pine Kernell, hauing a broad *Basis* aboue, and ending by degrees in an obtuse angle. [Tab. 4. fig. 1, F] This is placed in the midst of the double *Mediastinum*, and is embraced by it on either side, to which it groweth round about by the mediation of many Fibres. It is also tied before, to the *Pleura*, where the Gristles of the sixt and seauenth ribs on the lefte side are ioyned to the Membranes of the *Mediastinum*, where they part or gape from the brest-bone; behinde to the spine of the backe; below to the sinewy circle [Table. 4. fig. 1. from E to O] or Tendon of the Midriffe his point [Tab. 4. fig. 1. F] doth so strongly adhere especially on the left, as also on the right [Tab. 4. fig 1, S] side that it cannot be separated without tearing it asunder, and this Connexion is peculiar onely to man. For in other creatures as Dogges & Apes, it standeth off from the Midriffe and is not tyed to it.

His originall.

The Originall [Table. 4. fig. 1, B Fig. 2. A] of this Membrane at his *Basis* is large, produced from the coats which the *Pleura* affoordeth vnto the foure vessels which yssue out of the heart; for these vesselles in all that distance which is betweene the *Basis* or broad end of the heart and this *Pericardium*, haue not the common coate from the *Pleura*, becaufe it is employed in the frame of the *Pericardium*.

His substance & the reasons of it.

His substance both for thickneffe and strength (as *Galen* saieth in the first chapter of his sixt Book *de vsu partium*) is very proportionate; if it had been harder then it is, it wold haue offended the Lungs by pressing them; if softer, it self might haue bin pained by the bones: for as his position is betweene two contraries, so is his substance middle betweene two extremes

For it is so much softer then a bone, as it is harder then the Lungs; but indeede the *Pericardium* toucheth not the Lungues but by the interposition of the *Mediastinum*, least they should hinder another in their motion, alwayes [except the forepart of the brest-bone, where the Membranes of the *Mediastinum* stand of one from another.

This purse is hard, because of the continuall motion of the heart; on the outside fibrous, within smooth and slippery, that the heart might mooue more freely in it, but on neyther side hath it any fat, although *Aristotle* saith otherwise, whom *Vesalius* imagined to bee deceyued by taking for it the Membranes of the *Mediastinum*, which are indeede sometimes fat as we haue saide.

His Connexions.

It is tied at the *Basis* of the heart, which is at the fift rackbone of the Chest, to the vessels which come thence [Tab.4.fig.1, [B] fig.2 [A]] which also it boulstereth; but to the body of the heart it is not tied but is as farre from it at the Basis, the point and the sides [Tab. 4. fig. 2 [BB] sheweth the *Pericardium* bent backe to the sides] as is sufficient for the dilatation of the heart, and for the serous humor heerein conteined. Wherefore it is on euery side a little distant from it; which distance if it had been larger it would haue taken vp too much of the cauity of the chest, and so haue bin a hinderance to Respiration.

His perforations.

It is continuall or whole round about except in the basis, where it hath at the least fiue perforations for the entrance of the hollow veine [Tab.4.fig.1 [A] Fig.2.[F]] & for his egresse, as also to let out the arteriall veine, [Tab. 4. fig.2 [G]] the Venall Artery, and the great Artery. [Tab.4,fig.2 [H]]

Table 4. figure 1. sheweth the heart included within his purse or Pericardium, *together with the Lungs, and a part of the Midriffe.*

Figure second, sheweth the Pericardium opened, and so the situation of the hart and particularly the fore-parte thereof.

TABVLA. IIII.

FIG. I.

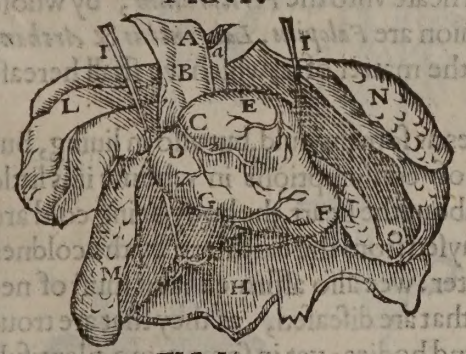
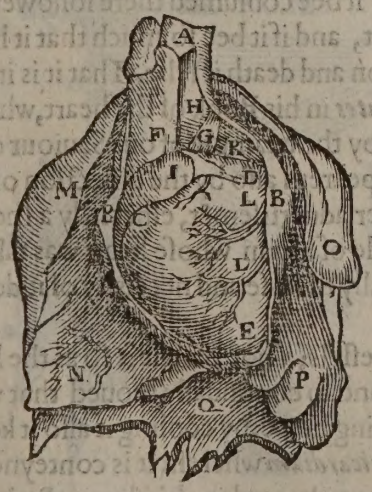


FIG. II.



A. A portion of the ascending ttunke of the hollow Veine.

a. A portion of the Great Artery.

B. The beginning of the *Pericardium*, cleuing very close to the hollow veine, vnto the Arteriall veine and to the Great Artery.

C. The small Veines of the *Pericardium* or Purse of the heart.

D E. The foreside of the *Pericardium* bearing the Figure of the Basis of the heart.

F. The sharpe end of the Pericardium.

From F to G. the connexion of the *Pericardium* with the Midriffe.

H. A part of the *Septum transuersũ* or the midriff

II. His Nerues.

L M N O. The foure Lobes of the Lunges.

The second Figure.

A. The place where the *Pericardium* is continued with the vesselles of the heart.

B B. The *pericardium* reflected to the sides.

C D. The Basis of the fore-part of the hart.

E The point of the fore-part of the heart called *Mucro*.

F. The Hollow Veine.

G. The Arteriall veyne.

H. The great Artery and the Venal artery, which cannot be seene vnlesse the heart be leaned to the left side.

I. The right eare of the heart.

K. The top of the left eare.

l. The coronary or crown-veine and artery of the heart.

L L. Certaine branches proceeding from these vessels.

M N O P. The foure Lobes of the Lungs.

Q. A part of the Midriffe.

It

His veſſels. It receiueth very ſmall veines [table 4. figure 1. C] and threddy, partly from thoſe that are ſent to the *mediaſtinum*; partly from the veins called *Phrenicæ* where they are ioyned to the midriffe; ſome ſay it hath a ſmall braunch from the *Axillary* veine which they call the *Capſulary* or purſe-braunch; though *Laurentius* will haue it to come from the *ſubclauian* veine. It hath no arteries vnleſſe they be exceeding ſmal, becauſe being ſo neare vnto the heart it may receiue vitall ſpirits at hand from it. His nerues are very ſmall and ſometimes ſcarcely ſenſible, but from the left branch of the Recurrent ſinew to giue him ſence.

His vſes. His vſe is to be as a habitation and ſhelter for the heart or as a mantle to couer it, and being of all membranes (except the *dura mater* of the Braine) the ſtrongeſt, it keepeth it alſo from preſſure that his motion bee not impeached, and that it touch not the hard bone. Moreouer it conteyneth a ſerous humour whereof wee will ſpeake in the next place, and ſerueth in ſtead of a ligament together with the helpe of the membranes of the *Mediaſtinum* to reteyne the heart in his right ſeate. *Galen* in the 13. Chapter of his 7. Book *de Anatomicis Admin.* telleth a ſtrange ſtory of a childe whoſe breaſt-bone was cut out, and this *Pericardium* rotted part of it off, and yet the child recouered.

A ſtory.

The humour contayned in this purſe. In this purſe there is contayned a watery humour as *Galen* calleth it, carrying the forme of vrine: wherefore the diuine ſenior *Hippocrates* who in his Booke *de Corde* calleth it ὑδρωψ, ſayeth that the heart dwels in a Bladder, yet this water hath no acrimony or ſaltneſſe in it.

What is the matter of it. It ſpringeth partly from a humour which ſypeth out of the veſſels (I meane the veines and arteries of the heart) which the heart as *Hippocrates* ſpeaketh drinketh in, licking vp withall the drinke of the Lungs and piſſeth it out againe (for the watery humor is by the high feruour of the heart driuen forth, as we ſee in greene wood when it is burnt) partly of a portion of the drinke which ſoaketh in the paſſage through the ſides of the weazon, as it were a deaw and falleth downe hither, and from hence ſome of it into the venall arteries. The firſt

That it ſipeth out of the veſſels. is proued by the cure of the palpitation of the heart which is cauſed of the aboundance or ouerplus of this humour, which is turned ſayeth *Galen* in the ſecond Chapter of his fift Booke *de locis affectis* by bloud letting; when together with the bloud the ſerous humour is let out which before fel into the *Pericardium*.

That it is part of our drinke. The latter is euicted by an example propounded by *Hippocrates*, for ſayth he, if you giue a Pigge that is very dry water mingled with minium or vermilion and preſently ſtick it, you ſhall finde all his winde-pipes along dyed with this coloured drink; ſome would haue it to be generated from moyſt vapours and exhalations rayſed from the humours of the heart, and driuen forth by his perpetuall motion and high heate vnto the *Pericardium*, by whoſe denſity they are turned into water: and of that opinion are *Falopius*, *Laurentius* & *Archangelus*; who remembreth ſixe opinions concerning the matter of it, which we ſhall hereafter make mention of.

That it is found in liuing bodies. But more in dead and why This humour is found not onely in dead bodies as ſome would, but alſo in liuing, but more plentifull after death (except in thoſe that die of conſumptions in whome it is little and yellowiſh) becauſe the many ſpirits which are about the heart, the body being cold are turned into water euen as thoſe vapors which are rayſed from the earth are by the coldnes of the middle region of the ayre conuerted into water: wee alſo affirme that it muſt of neceſsity be in liuing bodies, and not onely in thoſe that are diſeaſed, as they that are troubled with palpitation of the heart, but alſo in all ſound bodies; yet in ſome more plentifull

In ſound bodies as wel as in diſeaſed. in others more ſparing, but in all moderate; becauſe if it bee conſumed there followeth a conſumption, if it be aboundant palpitation of the heart, and if it bee ſo much that it hinder the dilatation of the heart then followeth ſuffocation and death it ſelfe. That it is in liuing bodies may be proued by the teſtimony of *Hippocrates* in his Book of the heart, where he ſayeth there is a little humour like vnto vrine, as alſo by the example of our Sauiour out

The example of our Sauior of whoſe precious ſide iſſued water and bloud. It appeareth alſo by the diſſection of liuing creatures which euery yeare is performed for further aduertiſemẽt, eſpecially a ſheep or ſuch like great with young, *Veſalius* addeth an example of a man whoſe heart was taken out of his body whileſt he liued at *Padua* in *Italy*. Finally the vſe and neceſsity of it doth euict the ſame.

The vſes of it. For the vſe of it is to keepe moyſt the heart and his veſſels; a hot part, it is ſo as the left ventricle will euen ſcald a mans finger if it be put into it, and ſo continually moued that vnleſſe it were thus tempered it would gather a very torrifying heate, by cooling it alſo it keepeth it freſh and flouriſhing. It moyſtneth alſo the *Pericardium* wherein it is conteyned, which otherwiſe by the great heate of the heart would bee exiccated or dried vp. By it alſo

so the motion of the heart becommeth more facile and easie, and this motion spendeth it and resolueth it insensibly by the pores as it is bred; but if in the passage it bee stayed then saith *Varolius* are there many hairs found growing right against it on the brest. Finally, it taketh away the sense or feeling of the waight of the heart, because the heart swimmeth as it were in it, euen as we see the infant swimmeth in sweate in the wombe, aswell to take away the sense of the waight of so great a burthē from the Mother, as also that it might not fal hard to any part in her body; you may add to this if you please, that it helpeth forward the concretion of the fat about the heart. The cause of haire vpon the brest.

In the cauity also of the Chest there is found such a like water mingled with blood with which the parts of the chest are continually moistned and cooled. And thus much of these circumstances of the heart. Now followe the Vesselles of the chest. Another water and blood mingled in the Chest.

CHAP. IX. *Of the ascending trunke of the Hollow veine.*

THE trunke of the Hollow-veine hauing perforated the *Diaphragma* or Midriffe, [Tab 5. fig. 1. from A to D Table. 6. from B to B] runneth along the Chest as high as the Patell-

Tab. 5. Fig. 1. sheweth the diuision of the Hollow-vein in the Iugulum *or hollow vnder the Patel-bones. On the right side is shewed how it is commonly beleeued to bee diuided into two trunkes, the one called the* Sub-Clauius, *the other* Super-Clauius, *from whence came that scrupulous choise of the* Cephalica *and* Basilica *Veines in Phlebotomy or blood-letting. On the right side is shewed how the trunke is but one, out of which both the foresaid veines of the arme do proceede.*

Fig. 2. sheweth a portion of the Hollow veine as much as ascendeth out of the right ventricle of the hart vnto the Iugulū, wherin is exhibited the nature of the Fibres which are in the bodies of the veines.

TABVLA. V.

FIG. I.

FIG. II.

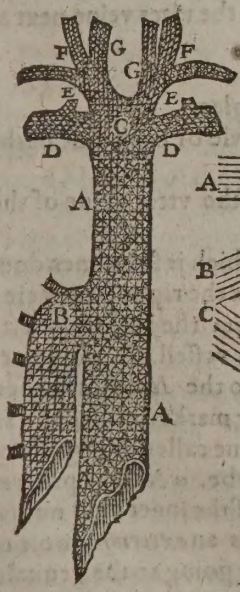


FIG. III.

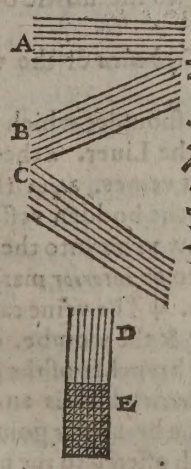
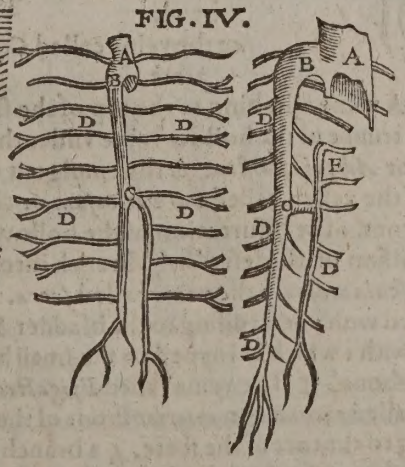


FIG. IV.



A A. The trunke of the hollow vein from the heart to the Iugulum or Sticking-place.
B. The Coronary veine of the heart.
C. The veine *Azygos* or *sine-pari*.
ddd The branches of the foresaide veine called *Intercostales inferiores*.
D. The diuision of the hollow Veine in the *Iugulum*.
E E. The *Mammarie Veines*.
F. The vpper Intercostall veine.
G The veine called *Subclauia*.
H H The *Cephalica* or head veine yssuing there-from.
I I. the veine called *Hepatica* or the Liuer veine issuing also from the *Subclauian* trunke marked with G.
K K The internall iugular veine.
L L The externall iugular veine.
M. The *subclauian* veine, out of which issueth the right Liuer veine at Q.
N. the *superclauian* veine out of which issueth the right head veine at P.
O O. the veines called *Cervicales* or neck veines. Q the *Hepatica* or liuer-vein.
P. the *Cephalica* or Head veine.

The 2. Figure.

A A The trunke of the Hollow-veine.
B. the vein *Azygos* or the vnmated vein.
C. the diuision of the hollow vein in the *Iugulum*, on either side into two branches as it is commonly receiued.
D D. the *subclauian* branches.
E E. the *superclauian* branches.
F F. the externall iugular veines.
G G. the internall iugular veines.

Fig. 3. sheweth a rude delineation of the Fibres in the bodies of the veines.

A. the transuerse or ouerthwart Fibres.
B, C. the oblique or slope fibres of each kind
D. the right fibres.
E. the implication or texture of the 3. kinds of Fibres.

Fig. 4. sheweth the distribution of the Veine Azygos, which we shal shew more distinctly in the 7. Table.

A, A part of the trunk of the hollow vein
B. the originall of the veine *Azygos*.
C O. the diuision of the same vn-mated veine at the eight rib. DDDD the right and left intercostall veines.

bones before it be diuided. It is greater then the deſcending trunke, becauſe it is to conuay bloud to more parts; it hath alſo vnder it the *Thymus* or ſweete-bread, that thereby being boulſtered it might more ſafely be diuided.

4 branches before the diuiſion.

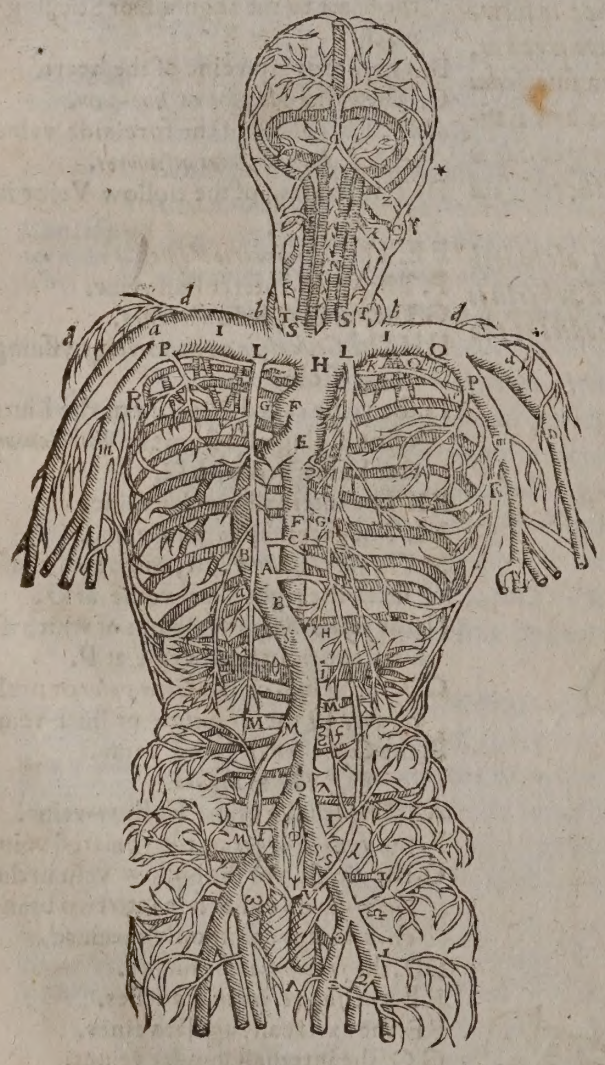
Before the diuiſion it ſendeth out foure branches.

Phrenica. 1

The firſt is called *Phrenica* [Table 6.[c]] or the veine of the midriffe, one on each ſide, which diuerſly are diſſeminated through the midriffe, & beſide it tranſmitteth branches to the *Pericardium* and the *Mediaſtinum*: the right iſſueth out of the trunke ſometimes in the cheſt, the left alwayes vnder the midriffe: then the trunke of the hollow veine perforateth the *pericardium* and inclining a little to the left hand [table 6. aboue[B]] degenerateth into the right eare of the heart [table 6.[D]] and is faſtned into the right ventricle of the heart in-

Table 6. ſheweth the trunk and branches of the hollow vein as they are diſſeminated through al the three Regions of the body.

TABVLA. VI.



A The trunke of the hollow veine below the Liuer.

aa The roots of the ſame hollow veine proceeding out of the Liuer, which make the trunke thereof.

ß Another roote ariſing out of the hollow ſide of the Liuer,

B The ſeate of the hollow veine betwixt the Liuer and Midriffe.

C The veine *phrenica* or the veine of the Midriffe.

D The orifice by which the hollow veine groweth to the heart.

E The crown-veine of the heart.

FF The trunk of the veine *Azygos*.

GG The *interceſtall* veines proceeding from the foreſaid trunke.

H The by-partition of the trunke of the hollow veine at the *Iugulum* or ſticking place.

II the *ſubclauian* veine tending to the arme.

K the vpper *Interceſtall* veine.

LL the *Mammary* veines deſcending.

M r The coniunction of the deſcēding *Mammary* vein at M with the *Epigaſtricall* veine at r.

NN the neck veine called *Ceruicalis*.

O the veine called *Muſcula*.

PP the vpper cheſt veine.

Q the double *Scapularie* or the veines of the ſhoulder-blade.

RR the lower cheſt veine.

SS the internall Iugular veine.

TT the externall iugular veines.

V the external iugular vein diuided into two vnder the roote of the eare.

X the inner branch thereof.

Y the outer branch thereof.

Z A braunch proceeding from the vtter veine next aboue named, to the face.

α the fore-head veine.

ä A branch creeping vp the temples.

* A ſurcle reaching to the nowle or back-ſide of the head.

aa the veine called *Cephalica* or the vtter veine of the arme.

bb the veine called *Muſcula ſuperior*. *dd* A veine climbing to the top of the ſhoulder which is ſomtimes double. *mm* the veine called *Baſilica*. *ζ* the trunke of the hollow veine vnder the Liuer. *κ* the right fatty veine or *Adipoſa dextra*. *ν* the left fatty veine or *Adipoſa ſiniſtra*. *θι* the emulgent veines. *λμμ* the right and lefte ſpermaticke veines. Y the beginning of the veſſell called *vas varicoſum* or the bodden veſſell. *ξ* the veines called *Lumbares* or belonging to the loynes. *ο* the bifurcation of the hollow veine into the *Iliack* branches. *π* the vpper veine called *muſcula*. *ρς* A diuiſion of the left *Iliack* branch into an *interior* marked with *ρ* and an exterior marked *ς*. *τ* The veine called *muſcula media*. *φ* the veine called *ſacra*. *ψ* The veine called *Hypogaſtrica* which is a branch of the inner bow marked with *χ* deſcending to the bladder & the wombe. *ω* A veine proceeding out of the externall branch marked with *ς* which is ioyned to the ſmall branches of the inner vein not far from the perforation or hole of the ſhare-bone. Γ The veine called *Epigaſtrica* which is an *exterior* ſhoote of the branch *ς* riſing vpward. Δ the veine called *pudenda*, an *interior* ſhoot of the braunch *ς* going to the genitals. Θ the firſt skin-vein of the leg deſcending to the toes of the feete. Λ a branch offered to the place of the groyn or lesk. Ξ a branch creeping through the skin of the thigh. Ω the vein called *muſcula inferior*, creeping through the place where the hip is articulated or ioyned with the thigh. 1 A vein diſtributed to the 7. and 9. muſcles of the leg. 2 A veine conueyed to the ſixt muſcle of the thigh.

o which as into a Cisterne it powreth his blood. The second is called *Coronaria cordis* [tab. 5.fig.2 [B]. Tab.6,[F]] the crowne veine of the heart, because like a Crowne it compasseth the Basis of the heart. This disperseth many branches through the outward surface of the heart euen to the Cone or point thereof especially on the left side, because the substaunce of it there is thickest and therefore needeth more Aliment. *Coronaria.*

Afterward the Hollow-veine perforateth the *Pericardium* againe, and againe groweth round but much lesse then before, and riseth vp where the right Lung is parted from the left, and so passeth to the *Iugulum*, but aboue the heart in the middest of the bodye it parteth with a notable trunke or branch to be distributed to the Spondels and the spaces betweene the ribs.

And this is the third branch called *Vena ἄζυγος*, or *sine pari*, that is, the vn-mated Veyne which we haue before called *Non-paril* [Tab. 5.fig.1. C.fig.2 [B] Fig.4 [E]] because commonly in a man it is but one, as also in Dogges, and hath not another on the other side like vnto it. *Vena ἄζυγος.*

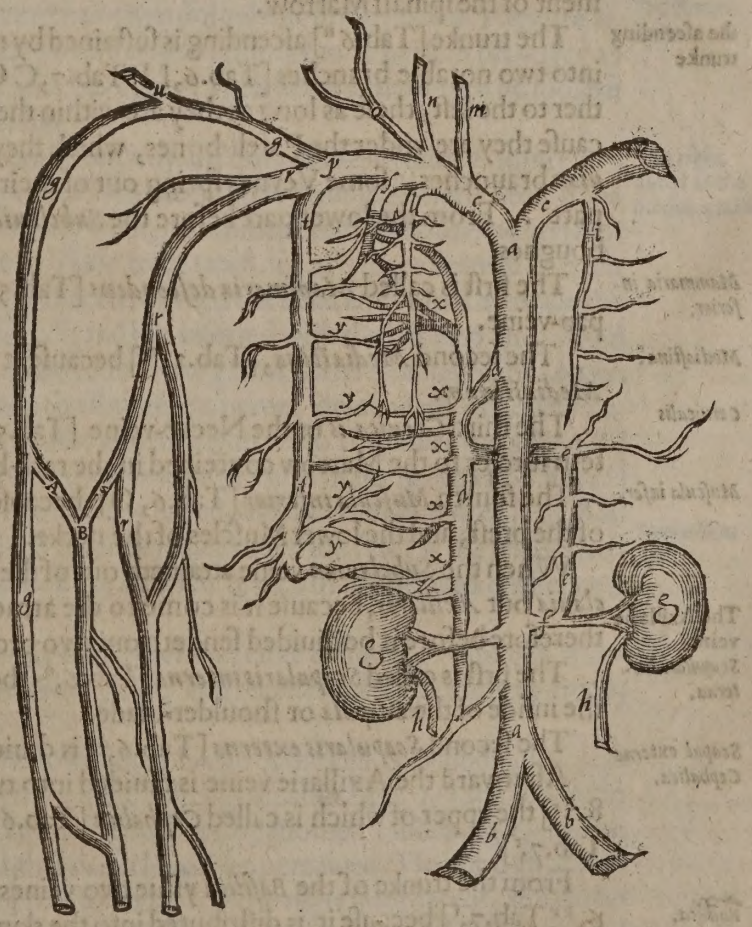
It ariseth out of the backward and lower side of the hollow veine [Tab.5.fig.4. [A]] aboue the hart, betweene the fourth and fift spondell of the Chest, but more toward the right side then toward the left. In those creatures that chew the cud it is double, as also in some men (happly in those that wee call *Ambidexters*, that can vse both hands alike) but verie rarely, yet *Fallopius* hath worthily obserued, that there is in men a left branch which doth the office of the *Vena sine pari* [Table 7,1] arising from the left *subclauian* branch, and affoordeth branches to some of the distances betweene the ribbes. Sometimes it ariseth not out of the

Why some men are ambi-dexters. *Fallopius.*

aa. The hollow vein from the *Iugulum* to the holy bone.
bb the diuision of the hollow vein into the Iliack branches.
cc The diuision of the hollow veine at the *Iugulum* on both sides into the *Subclauian* branches.
dd The trunke of the veine *Azygos* which insinuateth it selfe into a branch of the Hollow veine at *.
ee, f. A left branch from the veine *Azygos*, inserted into the emulgent veine at *f*.
gg The Kidnies.
hh the Vreters.
i The left vpper intercostall veine.
l the right descending Mammary veine.
m the internall Iugular veine.
n the externall iugular veine.
o the veine *Muscula* going to the Muscles of the necke.
p The diuision of the *subclauian* branch into the *Cephalica* & *Basilica* veines.
qqq the *Cephalica* vein cald also *humeraria*
rrr The *Basilica* veine, which some also call *Axillaris*.
ſ The vpper Chest-veine called *Thoracica*.
tt the lower chest-veine going to the outward Muscles of the Chest.
u A branch of the *Cephalica* veine deriued vnto the Muscles that lift vp the arme & to the skin therabout before it passe vnder the shoulder.
xxxx Certain veins in the Chest from the *Azygos*, which are vnited with the outward branches yssuing from the exteriour Chest-veine, which is deriued out of the *Basilica*.
yyyy The outwarde Veines of the Chest which are vnited with the inner braunches of the *Azygos*.
z A branch of the *Basilica*, which is ioyned with the *Cephalica*, which is ioyned with the *Basilica*.

Although it shewe the Trunke of the hollowe veyne dissemínated thorough both the Bellies, notwithstanding it serueth especially to exhibit the distribution of the veine Azygos, *and the coniunction of the branches thereof with the veynes of the Chest, which heere is onely shewed on the right side.*

TABVLA VII.



A branch of the *Cephalica*. A branch of the *Cephalica*. B The veine called *Mediana* or the middle veine.

Subclauian branch, but out of the trunke of the hollow veine neere the third Spondel of the Cheſt before the diuiſion thereof.

The branches of *Vena ſine pari.*

Commonly from the trunke of the veine ἄζυγος [Tab.5.fig.4.[B] Tab.6.[FF] Tab.7.[d]] out of the backſide of it as well on the left hand as on the right, but on the right eſpecially branches are diſtributed to the diſtances, ſometimes of all but moſt what of the ten lower ribs, [Tab.5.fig.4] which are called *Intercoſtales rami* [Tab.6,[GG]] braunches betweene the ribs. This Veine alſo without his mate, affoordeth many ſurcles to the Gullet, and ſometimes nere the fourth Spondell of the Cheſt it ſendeth a branch vpwarde [Tab.7. at the vpper[d]] from which are deriued ſurcles to the foure vpper ribs.

The Intercoſtal branches.

The Intercoſtall branches alſo yeelde ſmall ſtrings of veſſels [Tab.7,[xxx]] which yſſue out of the Cheſt, which are inoculated with ſurcles of the veine called *Thoracica inferior*, [Tab.7.[yyy]] whence it is that we with good ſucceſſe in Pleuriſies open the *internall* Veyne of the affected ſide.

The diuiſion of *Vena* ἄζυγος.

The trunke of the ἄζυγος at the 8.or 9.rib is aboue the ſpine diuided into a right branch and a left [Tab.5.C,O] which both paſſe downward. The left which is the larger determineth into the midd e of the emulgent. The right is ioyned to the hollow veine aboue the emulgent, to the emulgent more rarely, moſt commonly it is implanted into the laſt veyne of the Loines, [Tab.7,*] and hence it is that in the beginning of the Pleuriſie it is profitable to open the veine in the ham or in the foote.

Intercoſtalis Superior

The fourth is that Veine we call *Intercoſtalis ſuperior*, or the vpper Intercoſtall vein [Tab.5,fig.1,[F]. Tab.6,[K]] on each ſide one ariſing from the *Subclauian* braunch about the beginning of the Iugular veines [Tab.6.ST] and reflected vnder the Artery of the arme, and is diuided into two branches eſpecially on the right ſide, which are diſtributed to the diſtances of the two vppermoſt ribs, ſometimes to the three vppermoſt, and are ioyned with the Mammarie branches which creepe along the griſtles. [Tab.6.[LL]] But this Vein is ſomtimes wanting, that is, when the Veine ἄζυγος affoordeth branches to all the ribs, as we ſaid euen now that ſometimes it did. Alſo from all the Intercoſtall veynes there are ſmall tendrilles which paſſe into the holes of the racke-bones for their nouriſhment, as alſo for the nouriſhment of the ſpinall Marrow.

the aſcending trunke

The trunke [Tab.6[H]] aſcending is ſuſtained by the Sweete-bread [Tab. 3,[F]] and diuided into two notable branches [Tab.6,I I. Tab.7,C C] one tending to the right hand, the other to the left, theſe as long as they are within the Cheſt, are called *Rami ſubclauij*, becauſe they are vnder the Parell-bones, which they call *Claues*. From each of theſe *Subclauian* braunches, ſome Veynes ſpring out of their vpper part, ſome out of theyr neather part. From the lower part before the *Subclauian* braunch is diuided dooe yſſue foure boughes.

Mammaria inferior.

The firſt is called *Mammaria deſcendens* [Tab.5.fig:1,[RR]. tab.6,[LL]. ta.7,[l]] the deſcending pap-veine.

Mediaſtina.

The ſecond *Mediaſtina*, [Tab.2,[Q]] becauſe it is Diſſeminated eſpecially through the *Mediaſtinum.*

Ceruicalis

The third *Creuica'is* or the Necke-veine [Tab.5.[OO]. Table 6,[NN]] becauſe it communicateth ſurcles to the Marrow conteined in the rack-bones of the necke.

Muſcula infer.

The fourth *Muſcula inferior* [Tab.6, O] becauſe it is diſtributed into the vpper Muſcles of the breſt, and the lower Muſcles of the necke.

When the *Subclauian* veine attaineth out of the Cheſt [Tab.7,[P]] it is called no more *ſubclauia* but *Axillaris*, becauſe it is come to the arme-hole called *Axilla*. The Axillary veine therefore before it be diuided ſendeth out two propagations.

The Axillarie veine.

Scapularis interna.

The firſt is called *Scapularis interna* [Tab.6,[Q]] becauſe it is diſperſed to the Muſcles on the inſide of the *Scapula* or ſhoulder-blade.

Scapul externa Cephalica.

The ſecond *Scapularis externa* [Tab.6,[d]] is diuided to the outſide of the blade.

Afterward the Axillarie veine is diuided into two branches [Tab.5,[HL]. table 6.[am]. table 8.[qr]] the vpper of which is called *Cephalica* [Tab.6.[a] Table 7,[q]] the lower *Baſilica*. [Tab.6[m] Tab.7,[r]]

Baſilica. Thoracica ſup. Thoracica infer

From the trunke of the *Baſilica* yſſue two veines. The firſt called *Thoracica ſuperior* [Tab 6,[PP] Tab.7,[c]] becauſe it is diſtributed into the skin and Muſcles which couer the cheſt.

The ſecond *Thoracica inferior* [Tab.6[RR]. Ta.7,[tt]] becauſe it runneth along the ſide of the Cheſt, and the branches of this Veine are inoculated [Table 7, [yy]] with the ſurcles of the Veine ἄζυγος. Table 7[xx]]

From

From the vpper part of the *ſubclauian* veine 3. veines doe ariſe.

The firſt is called *muſcula ſuperior* [table 7° table 6.[bb]] becauſe it is diſtributed into the muſcles and skin on the backſide of the necke. *Muſcula ſuperior.*

The ſecond *Iugularis externa* [tab. 5. fig. 1.[ll] tab. 6.[rr] tab. 7.[n]] is commonly on each ſide one, but ſometimes double, and is againe diuided vnder the roote of the eare. *Iugularis externa.*

The third *Iugularis interna* [table 5. fig. 1[kk] tab. 6.[rr] tab. 7.[m]] is greater in a man then it is proportionably in other creatures, becauſe a mans brayne is greater; iuſt at the head it is diuided. *Iugularis interna.*

But becauſe all theſe veines we muſt handle more acurately in our booke of the veſſels, it ſhal be ſufficient here only to haue named them and ſhewed them vnto you, we proceed to the Nerues.

CHAP. X. *Of the Nerues in the Cheſt and the necke.*

THE Nerues diſſeminated through the Cheſt and the necke are of two ſorts, yet all proceeding from the marrow of the brayne; the firſt ſort whileſt the marrow is in the skull, the other after it is in the racke-bone, and is called *ſpinalis medulla.*

Out of the marrow yet in the skull: the ſixt paire come. [ta. 8. fig. 1:[ee]] They ſeeme to be but one nerue, but indeed are two inueſted with one membrane, and paſſe out at a hole betweene the nowle and the temporal bones. The *anterior* and leſſer part of this nerue is diſſeminated into the muſcles of the tongue and into the mouth. The *poſterior* and greater ſendeth branches to the muſcles of the neck, [table 8. figure 1.[f]] to the ſecond mouing the ſhoulder blade, and deſcending more inward to the muſcles that are in the cauity of the *larynx* or throttle [table 8. figure 1.[q]] ſome ſlender ones alſo to the muſcles of the bone *Hyois.* The ſixt paire of ſinewes.

Aboue the *Iugulum* or Region of the Coller-bone before it enter into the Cheſt, this branch is diuided into two [tab. 8, fig. 1.[h]] boughes, the one outward and the greater, the other inner and the leſſe.

The outward bough maketh the Recurrent nerues, found out firſt by *Galen.* They are alſo called the Vocall nerues, becauſe if they bee wounded, the creature looſeth his voyce as we haue often tryed in the diſſection of liuing Dogges, for if one be cut or tyed he looſeth halfe his voyce, if both, he looſeth it wholly. The Recurrent nerues.

The outward branch of the right nerue preſently after the diuiſion [table 8. figure 1.[h]] ſendeth ſurcles on both ſides [tab. 8. figure 1.[kk]] to the muſcles ariſing from the breſt-bone and the *clauicles* or coller-bones; & preſently when it commeth to the *Axillary* artery [tab. 8. fig. 2[r]] it tranſmitteth as it were about an Axle-tree [tab. 8. fig. 2.[r]] three braunches from the inner ſide [tab. 8. fig 1.[l]] which being reflected toward the head and vnited do make the right Recurrent; [tab. 8. fig. 2. [qq] and fig. 1.[m]] and it is inſerted with the left into the ſecond griſtle of the *larynx* [ta. 8. fig. 1.[n]] and implanted into the *glottis* & the muſcles of the *larynx.* The right nerue of the 6. coniugatiõ.

The foreſayd branch after it hath made the Recurrent nerue, deſcendeth obliquely vnder the coller-bone, and in the way outwardly affordeth ſurcles to the *pleura* [ta. 8. fig. 1.[qq]] and to the coat of the lungs, inwardly to the *pericardium* or purſe of the heart [tab. 8. fig. 1.[r]] and to the heart it ſelfe, and then maketh the nerue called *Stomachichus dexter* or [tab. 8. figure 1.[ſt]] the right ſtomacke nerue which reacheth ouer to the left ſide, as the left doth to the right ſide, and ſo at length is conſumed into the left orifice of the ſtomacke, whence it hath his denomination. *Stomachicus dexter.*

The inward branch of the right nerue is called *Coſtalis* [table 8. figure 1.[iii]] which affordeth braunches to all the bowels of the lower belly, and reacheth as far as the holy-bone, and is diſtributed into three branches. *Coſtalis* hath 3. branches.

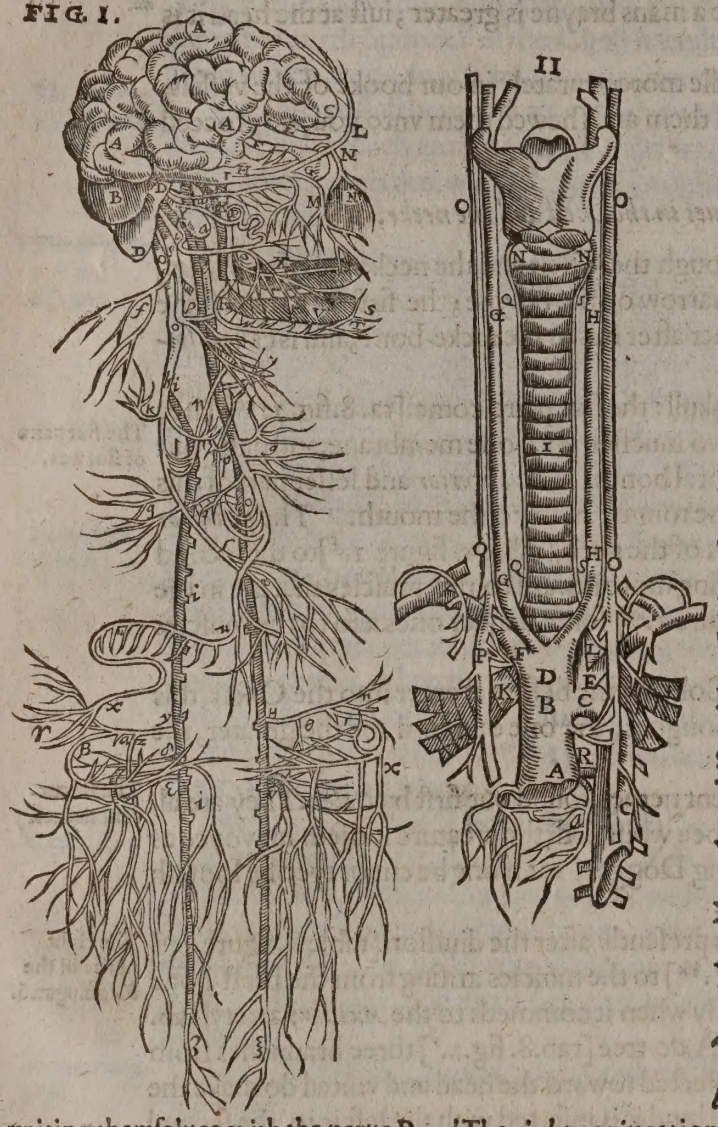
The firſt [tab. 8. fig. 1.[y]] creepeth to the lower membrane of the kell, & is ſubdiuided into three ſmall branches, whereof one goeth to the Collick gut [table 8. fig. 1.[ζ]] and this is the reaſon that after a long fit of the collicke men grow hoarſe; another [table 8. fig. 1.[α]] to the beginning of the guts which is ſo ſmall, that it can hardly be perceiued. The third affordeth ſurcles [tab. 8. fig. 1.[β]] to the bottome of the ſtomacke: on the right ſide thereof, and to the vpper membrane of the kell, the reſt of it is ſpent in the coat of the Liuer [tab. 8. fig. 1.[γ]] and the bladder of gall. The ſecond and the lower [tab. 8. fig. 1.[δ]] reacheth to the right kidney, and hence it is that men vomit in fits of the ſtone.

The third which is the greateſt [ta. 8. fig. 1.[ε]] paſſeth to the Meſentery and the guts. The

Table 8. *Figure* 1. *ſheweth the Brayne and the after-Brayne or Cerebellum together with the nerues (as the common opinion is) proceeding out of them: and this Table we haue eſpecially ſet in this place to ſhew the diſtribution of the nerues of the ſixt coniugation through both the bellies.*

TABVLA VIII.

FIG. 1.



A The Brayne.
B The *Cerebellum* or after-brayne.
C A proceſſe of the braine, but not that which is called *Mammillaris*.
DD The marrow of the backe as it is yet within the skull.
E The *Mammillary* proceſſe or inſtrument of ſmelling.
F the opticke nerue.
G the coate of the eye into which the opticke nerue is ſpread.
H the nerue that moueth the eye or the ſecond payre.
I the third coniugation, or the harder and leſſer branch of the nerues of the third coniugation brought forward.
K The fourth coniugation or the greater and thicker Nerue of the third payre bending downward.
L A branch of the nerue marked with I, which goeth to the fore-head.
M Another braunch of the nerue I, reaching to the vpper iaw.
NN A nerue proceeding from the branch I, interxed or wouen with the coate of the noſe.
O the nerue of the tẽporal muſcle yſſuing from the branch, I.
P A nerue contorted of the nerues K and b.
Q A nerue proceeding from the braunch K, to the ſoccets of the vpper teeth.
R A nerue creeping from the nerue K, to the lower iaw.
S A ſurcle of the branch R offered to the lower lip.
TT other ſurcles from the branch R attayning to the lower teeth.
V V A branch of the nerue K, diffuſed into the coate of the toung.
XX the fourth paire of ſinewes which goe into the coat of the pallat.
Y the fiſt payre of ſinewes which are the nerues of hearing.
a The membrane of the eare, vnto which that fiſt nerue goeth.
b c Two ſmall branches of the fiſt coniugation vniting themſelues with the nerue P. *d* The eight coniugation or a nerue of the fiſt payre attayning vnto the face. *ee* The ſixt payre of nerues. *f* A branch from the nerue *e*, reaching to the muſcles of the neck. *g* Smal branches deriued vnto the throttle or *larynx*. *h* the byfurcation of the nerue into two branches. *i i i* An inner branch hanging to the rack-bones, and ſtrengthning the *intercoſtall* nerues, and is therefore called *Intercoſtalis*. *kk* Surcles of the vtter braunch going to the heades of the muſcles, to the breaſt-bone and to the coller-bones. *lm* branches of the right nerue *l*, making the right Recurrent nerue. *mn* the inſertion of the Recurrent ſinewes into the muſcles of the *larynx*. *op* branches of the left nerue *o*, making the left Recurrent ſinew *p*. *qq* branches from the ſixt coniugation going to the coat of the lungs. *r* Small nerues of the heart and of the purſe thereof called the *Pericardium*, as alſo ſome approaching to the coate of the lungs. *ſ* nerues on either ſide ſent to the ſtomack. *t* the right ſtomacke nerue going to the left orifice of the ſtomack. *uu* the left ſtomack nerue going to the right orifice of the ſtomack. *x* A nerue from the branch *u*, paſsing into the hollownes of the liuer. *y* the nerue belonging to the right ſide of the kell. *z* the nerue belonging to the collick gut. *α* A nerue creeping to the gut called *duodenum* and the beginning of the *ieiunum* or empty gut. *β* A nerue implanted in the right ſide of the bottom of the ſtomack. *γ* A nerue belonging to the Liuer and bladder of gall. *δ* A nerue reaching vnto the right kidney. *ε* A branch reaching the *Meſenterium* and the guts. *ζ* A braunch ſprinkled to the right part of the bladder. *η* A branch going through the left part of the kell. *θι* Surcles deriued to the collick gut & the kell. *κ* Smal branches inſerted into the ſpleen. *λλ* A nerue approaching to the left ſide of the bottom of the ſtomack. *M* a branch belonging to the left ſide of the *meſentery* and the guts. *ν* A branch which attayneth to the left kidney. *ξ* Small nerues creeping through the left ſide of the bladder. *ο* The 7. payre of ſinewes. *π* A branch deriued from the ſixt coniugation to the muſcles which ariſe from the proceſſe called *Styloides*. *ρ* A branch of the 7. coniugation which goeth to the muſcles of the toung, of the bone *Hyois*, and of the throttle or *larynx*. *σ* A conũction or coition of the ſixt and 7 paire into one nerue.

Figure 2. *exhibiteth the Recurrent ſinewes together with a portion of the great Artery and the Rough Artery called the weazon.*

A The orifice of the great Artery cut from the heart. *aa* The coronall arteries. BCD The diuiſion of the great artery into two trunks, the deſcending C, the aſcending D. E The left *Axillary* artery. F The right *Axillary* artery. G The right *Carotis* or ſleepy artery. H The left *Carotis*. I the trunke of the rough artery. KL the diuiſion of the rough artery. M the head of the rough artery called the *larynx* or throttle. NN Certaine glandules or kernels at the root of it. OO the right and the left nerues. *P* a reuolution of ſmall branches of the right nerue to the right axillary artery. QQ The right Recurrent nerue. R a reuolution of ſmal branches of the left nerue to the deſcending trunk of the great artery. SS The left Recurrent ſinew.

reſt deſcendeth directly to the bladder. [Tab.8,fig.1,ζ]

The left Nerue of the ſixt coniugation [Tab. 8. figu. 1,ε Fig. 2 °] is diuerſified after the ſame manner with the right, and when it attaineth to the coller, is diuided into an outward and an inward branch. The outward communicateth it ſelfe to the *pleura* [Tab.8.fig,1 ϙ] & the coate of the Lungs, and deſcending to the trunke of the great artery [Tab.8,fig.1,C] tranſmitteth commonly three ſmall ſurcles, which being reflected and vnited [Tab,8,fig. 1 ϗ] make the left recurrent Nerue. [Tab.8,fig.1,ss] The remainder of this outward bough enclining to the right hand maketh the Nerue, which they call *Stomachicum ſiniſtrum*, the left Stomacke Nerue [Tab.8,fig.1,uu] which vnder the gullet is ioyned with the right Stomacke Nerue. [Tab.8,fig.1,ſ]

the left nerue of the 6. coniugatien

The leſte Recurrent.

The inward bough of the left Nerue paſſeth through the cheſt where it maketh *Siniſtrum coſtalem*, the left Rib-nerue, and vnder the Midriffe it is diuided into three branches. The firſt and vppermoſt [Tab.8.fig.1ω] goeth to the Kell, from which doe proceede two ſmall ſurcles, one to the collicke gut [Tab.8.fig.1,θ] and the lower Membrane of the Kel; [Tab. 8,fig.1,ι] the other to the bottome of the ſtomacke [Tab.8,fig.1,λλ] and the vpper Membrane of the Kell; that branch which remaineth is inſerted into the Spleene [Table 8. Fig. 1,χ]

His inwarde bough diuided into three

2 The ſecond [Tab.8.ſig.1,μ] runneth to the left ſide of the Meſentery, and vnto the guts thereabout, and ſometimes ſome ſurcles there-from accompany the Seminary Veſſels euen to the Teſticles.

3 The third [Tab.8,fig.1,ν] attaineth to the left Kidney: the remainder of the whole branch is conſumed in the left ſide of the bladder. [Tab.8,fig.1 ξ]

And thus much of the diuarication or diſtribution of the Nerues from the ſixt coniugation which yſſue from the marrow of the braine contained within the ſcull.

The Nerues that yſſue out of the marrow of the Braine after it is conteined in the ſpondels of the backe, and is commonly called *Spinalis medulla* are of two ſortes, ſome of the Necke, others of the cheſt.

Two ſorts of Nerues.

Of the Nerues of the Necke there are ſeauen pairs, and from the three laſt proceedeth one branch called the Midriffe-Nerue, made of three ſurcles al diſperſed into the *Diaphragma* or Midriffe.

Ceuicales pairs ſeuen.

Of the Nerues of the cheſt there are twelue paire called *Intercoſtales Nerui*, becauſe they pertaine to euery diſtinction betweene the Ribs, and runne cloſe to the bone on the the lower ſide thereof all along the length of it; for in the bottome of the Rib there is a cauity where the Artery veine and Nerue doe meete; and therefore when you ſhall open a mans ſide diſeaſed of the *Empyema*, you muſt make your inciſion at the vpper part of the Ribbe.

Thoracici pairs 12.

A note how to make inciſion in the *Empyema*.

And this ſhall ſuffice to haue ſpoken of the Nerues belonging to the cheſt at this time and in this place, the more accurate Diſcourſe you muſt looke for in our Booke of the Veſſelles.

CHAP. XI. *Of the Heart.*

THE heart is a principall part; not as *Ariſtotle* called it principall, who placed in it all the actions of life and ſenſe; but as being the fountaine of the Vitall Faculty and ſpirit, the place and nouriſhment of naturall heat, wherby the naturall heate of all the parts is preſerued, and by his influence repaired; the ſeate of the Iraſcible or angry parts of the ſoule, the root of the Arteries and Author of the Pulſe.

Names

It is called *Cor a currendo*, becauſe it ſeemeth continually to run, for that it is continually mooued. The Greekes call it καρδία, either of a worde which ſignifieth to beate or pante, which is our proper word for the beating of the heart; or from a word which ſignifieth a Bakers moulding-boord, becauſe in it the Alimentary blood is as it were kneded, wrought, moulded, and driuen out into thinneſſe, till it turne into a vitall ſpirite; or finally from a word which ſignifieth principality, becauſe it is a principall part as well as the braine; yet ſo that as the Braine is of greater dignity, ſo the heart is of greater neceſsity; for the leaſt hurt of this moſt what cauſeth death; and *Galen* ſaith, that death neuer happeneth but when the heart is immoderately diſtempered. Whereupon alſo *Ariſtotle* ſaith, There was neuer any creature ſeene without a heart, becauſe without it there can bee no Originall at all of heate.

The neceſſity of the Heart.

It

It is ſcituated in the midſt of the cauity of the cheſt in a Noble place as it were a Prince; and after the manner of thoſe which being but one do occupie the middeſt as well for ſecurity, as that the body may be equally ballanced. At the fift rib it is embraced by the lobes of the Lungs as it were with fingers [Tab: 3 N O P Q. Tab. 9. fig. 1 and 2. Table. 10, fig. 1, and 2] round about, that equally out of all the Lungs, it might draw breath by the venall arterie, and might againe deliuer ouer and diffuſe blood by the arteriall veine, and life and heat by the great Artery to all the outward parts, & it is locked vp in his owne Capcaſe [Tab. 9. fig 1, D E F. Fig. 2 BB] but ſo that the Baſis reſteth exactly in the middeſt, whether we regard the right hand or the left, the fore-part or the back, the vpper or the lower; but the point [tab. 9. fig. 2 E] reacheth to the left hand, yet forward as farre as the left Nipple, ſo that in a liuing man it looketh directly forwarde (with a kinde of ſtrutting poſition) to the Griſtles of the ſixt and ſeuenth ribs of the left ſide where they are ioyned to the breſtbone, that it may the better warme the forepart againſt which we moue. And truly it behooued that it ſhould encline to one ſide that it might giue way to the Midriffe, and ſo neither of their motions (which are both perpetuall) ſhould be hindred; but not vnto the right ſide, for that the hollow veine takes vp as he aſcendeth thorough the cheſt; happely alſo Nature was heere of *Ariſtotles* minde in the fourth chapter of his third Booke *de partibus Animalium* (for he was often of hers) that the leſte ſide was the colder and therefore ſhe placed this hot part in it; for on the right are the hollow veine and the *Non-paril*, which heate it ſufficiently; and ſo both ſides are prouided of heate and ſtrength alike. Notwithſtanding the common people are deceyued, who thinke it lyeth wholy on the left ſide becauſe the motion and pulſation is moſt felt on that ſide, when indeede it lyeth in the very middeſt, as in the more Noble place; but the left ventricle which is the Store-houſe of ſpirites and the great arterie were the cauſe of their error, as *Galen* ſaith in the ſecond chapter of his ſixt Book *de vſu partium*. Add heereto, that in dead carkaſſes it is drawn ſomewhat to the left ſide, partly by his own waight, partly by the waight of the great artery which is faſtned vnto it.

Why it ought to encline to one ſide.

Why to the left.

The common error of the multitude.

His connexiō.

It is tied by the mediation of the *Pericardium* or purſe to the *Mediaſtinum* [Tab. 9. fig. 1. from F to G] and to the Midriffe, as alſo by his veſſels to other parts. For *Galen* ſaith, that principals in ſom things are to be tied together, and communicate one with another: otherwiſe it is looſe, that it may mooue the more freely.

His Figure.

The Figure of it as *Hippocrates* ſaith in his Booke *de Corde* is *Pyramidal*, [expreſſed ſo in the Tab. 9. fig: 2] or rather turbinated and ſomewhat anſwering to the proportion of a Pine Kernell, becauſe a man is broad and ſhort cheſted. For the Baſis aboue [Tab. 9. fig: 2, C D] is large and circular but not exactly round, and after it by degrees endeth [Tab. 9, figu: 2, E] in a cone or dull and blunt round point; for ſuch a figure was fitteſt for his function, becauſe length maketh much for traction or drawing, & roundnes for amplitude & ſtrength: ſo in great dilatations it is ſphericall that it might hold more; and in his contractions long and as it were Pyramidall, eſpecially in bruite beaſts.

The names of the Baſis.

His ſuperiour part which is called the Baſis, the head, and the roote [Tab. 9. fig: 2 C D] is broader becauſe of the veſſels which in that place haue ingate and outgate, haply alſo becauſe of his motion, that in this broad Baſis the excauations or cauities might be the larger that when it is contracted both kindes of Blood arteriall and venall might haue place and room to retire to, and not be too vehemently wrought or pent vp in too ſtraight a room, leſt it ſhould violate the continuity of his ſubſtance or of the fibres therein.

The names of the Lower end.

His lower part is called the *vertex* or top, *Mucro* or point, the *Cone*, the heighth of the heart. *Hippocrates* calleth it the taile [Tab. 4. figure. 2 E] which *Galen* ſaith in the ſeauenth chapter of his 6. Booke *de vſu partium* is the baſeſt part, as the Baſis is the nobleſt. Before the heart is gibbous or bunching, behinde hollow and in the ſides prominent. The Superficies or ſurface of it is ſmooth and polliſhed all ouer, were it not that in ſome places the Fat, in other the Coronarie veſſelles ſtrutting with bloode, did make it vnequall.

His quantitie or magnitude

His quantity or magnitude is not alike in all, & in a man proportionably, as alſo the brain and the Liuer greater then in other creatures being as long as the bredth of ſixe Fingers & four broad, and ſo many high. But in fearfull creatures as the hare, Hinde, aſſe, and ſuch like it is proportionably very great, for the heat when it hath too much ſcope or roomth (ſayth *Ariſtotle*) is eaſily diſſipated and vaniſheth.

The parts of the heart. Externall.

The parts of the heart are ſome externall, others internall. The externall are the Purſe, of which we haue already ſpoken, the coate, the fat, the veſſels which are of two ſorts, ſome which encompaſſe the hart, others which reach vnto the entrances into his Ventricles and

the

Table 9. figure 1. *ſheweth the heart included within his purſe or* Pericardium, *together with the Lungs, and a part of the Midriffe.*

Figure ſecond, ſheweth the Pericardium opened, and ſo the ſcituation of the hart and particularly the fore-parte thereof.

TABVLA. IX.

FIG. I.

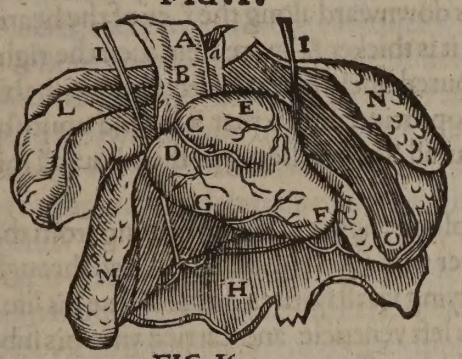
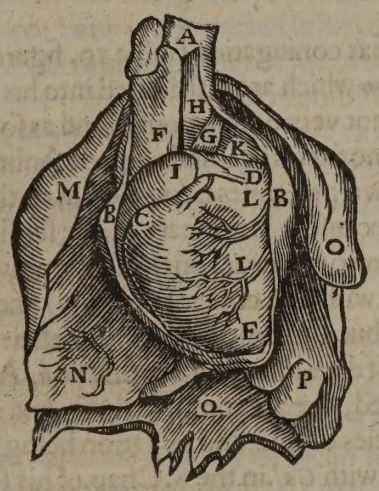


FIG. II.



A. A portion of the aſcending trunke of the hollow Veine.

a. A portion of the Great Artery.

B. The beginning of the *Pericardium*, cleuing very cloſe to the hollow veine, vnto the Arteriall veine and to the Great Artery.

C. The ſmall Veines of the *Pericardium* or Purſe of the heart.

D E. The foreſide of the *Pericardium* bearing the Figure of the Baſis of the heart.

F. The ſharpe end of the Pericardium.

From F to G. The connexion of the *Pericardium* with the Midriffe.

H. A part of the *Septum tranſuerſũ* or the midriff

I I. His Nerues.

L M N O. The foure Lobes of the Lunges.

The ſecond Figure.

A. The place where the *Pericardium* is continued with the veſſelles of the heart.

B B. The *pericardium* reflected to the ſides.

C D. The Baſis of the fore-part of the hart.

E The point of the fore-part of the heart called *Mucro*.

F. The Hollow Veine.

G. The Arteriall veyne.

H. The great Artery and the Venal artery, which cannot be ſeene vnleſſe the heart be leaned to the left ſide.

I. The right eare of the heart.

K. The top of the left eare.

l. The coronary or crown-veine and artery of the heart.

L L. Certaine branches proceeding from theſe veſſels.

M N O P. The foure Lobes of the Lungs.

Q. A part of the Midriffe.

the eares. The inward parts are the fleſhy ſubſtance and the Fibres, the Ventricles and the Values or Flood-gates.

The coate is proper to the heart, very thin and fine. *Veſalius* likens it to the Membrane that compaſſeth the Muſcles, this inueſteth it as that of the Muſcles, and ſo ſtrengthneth his ſubſtance from which it cannot be ſeuered. The fat called *pinguedo* with *Columbus*, *or Adeps* with *Galen* and *Ariſtotle* or both with *Archangelus*, is very plentifully gathered about it like Glue, eſpecially at the *Baſis* where the greater veſſels are placed, becauſe there is the concoction celebrated of thoſe things that are conteined in it, & not in the Cone or point. This fat is harder then it is in any other part; and therefore it ſhould ſeeme rather to be *Adeps* then *Pinguedo*, and that is *Galens* and *Ariſtotles* reaſon; for if it were *Pinguedo* it would melt with the extreame heate of the heart to great diſaduantage. Howſoeuer the vſe of this fat is to moiſten the hart, leaſt being ouer-heated with his continuall motion it ſhould grow dry and exiccated, but this kinde of fatty humidity is hardly conſumed, but remaineth to cheriſh it, and to annoint and ſupple the veſſels that they cleaue not with too great heate and drought.

The Coate.

The Fatte of what kind it is

The vſe of fat.

Moreouer, the heart being the fountaine of heate which continually flameth, it ſerueth for a ſufficient and neceſſary Nutriment whereby it is cheriſhed and refreſhed, & in great affamiſhments nouriſhed and ſuſtained, leaſt otherwiſe the heart ſhould too ſoone depopulate and conſume the radicall moyſture. Wherefore *Galen* aſcribeth this vſe to fat, that in great heates, famines, & violent exerciſes, it ſhould ſtand at the ſtake to ſupply the want

of

of Nature at a pinch. So sayeth *Auicen*, Fats of all kindes are increased or diminished in the body according to the increase or diminution of heate, wherefore heate feedeth vppon them. We haue often obserued in opening of the ventricles of the heart, in the very cauities of them a certaine gobbet or morsell if not of fat yet of a substance very like it, so that we haue more wondred how that should in such a furnace congeale, then the other in the out side. The cone is alwayes moystned by the humor contayned in the *Pericardium*.

A substance like fat obser. ued in theven tricles of the heart.

The vesselles of the heart are of all kinds, which doe compasse the heart round about. [table 9. figure 2.[l] and branches from these [ll] table 10. figure 2.[p]] The veine is called *Coronaria* or the Crowne veine arising from the trunke of the hollow veine [table 6.[s]] before it bee inserted into the right ventricle, and sometimes it is double: this engirteth round like a crowne the *basis* of the heart, and hath a value set to it, least the bloud should recoyle into the hollow veine.

The veine cal led *Coronaria*.

From this crowne veine are sprinkled branches downward along the face of the heart, which on the left side are more and larger, because it is thicker & more solid then the right side. This bringeth good and thicke bloud, laboured onely in the Liuer to nourish this thicke and solid part, that the Aliment might be proportionable to that it should nourish. By this vessell also it may be beleeued that the Naturall Soule residing in the Naturall spirite is brought into the heart with all his faculties.

What nourish ment the hart needed.

The Arteries.

It hath also two Arteries called *Coronarias* [table 12. figure 1.[bb]] proceeding from the descending trunk of the great Artery, which together with the vein are distributed through his substance to cherish his in-bred heate, and supplying vitall spirites doe preserue his life: for if the heart did liue by the spirits perfected in his left ventricle and carried vnto his substance without Arteries, then also might the same spirit passe through the pores of the hart and so be lost.

By what spirits the heart liueth.

The nerues.

It hath also Nerues but very small ones, from the sixt coniugation [table 10. figure 1.[x]] or from the nerues which are sent vnto the *Pericardium* which are distributed into his *basis* [table 10. figure 2.[h]] close by the arteriall veine, but not very perspicuously; and as some thinke for sence onely and not for motion; because his motion is Natural and not Animal. But saith *Archangelus* if there must be but one and not two principles of motion in vs, then shall the Brayne be also the originall of all motions, because it is the seate of the sensible Soule; (for that opinion of *Aristotles* who attributeth vnto the heart onely all the powers and faculties of the soule, *Galen* and the later writers do with one consent disauow) and so this nerue shall minister vnto the heart not onely sence but also motion and both their faculties, and also the faculty of pulsation or the motion of dilatation and constriction. And this nerue sometimes though seldome is suddenly stopped, whence commeth hasty and vnexpected death, which wee call sudden death, the faculties of life and pulsation being restrayned so that they cannot flow into the heart. But we with *Gal.* in the 8. Chap. of his seauenth Booke *de Anatom. Administ.* will determine for our partes, that the faculty of pulsation ariseth out of the body of the heart not from the nerues; for then when these are cut away, the pulse should cease; and the hart taken out of the chest could not be moued, which we find otherwise by dissection of liuing creatures.

Archangelus his conceit that the motion of the hart commeth frō his nerues.

A cause of sudden death.

CHAP. XII. *Of the substance, ventricles and eares of the heart.*

The substāce of the heart. Why so thick.

THE substance of the heart is a thicke [table 10. figure 3. sheweth this] and red flesh, being made of the thicker part of the bloud; it is lesse redd then the flesh of muscles but harder, more solide and dense, that the spirits and inbred heate which are contayned in the heart and from thence powred into al parts of the body should not exhale; and that it might not bee broken or rent in his strong motions and continuall dilatation and constriction. And it is more compact, spisse and solid in the cone then in the *basis*, because there the right fibres meeting together are more compact, right as it is obserued in the heads or tendons of the muscles. This flesh is the seat of the vitall Faculty and the primary and chiefe cause of the functions of the heart, which consiste especially in the making of vitall bloud and spirites. For it hath all manner of fibres right, oblique and transuerse, most strong and most compact and mingled one with another (and therefore not conspicuous as in a muscle) as well for the better performance of his motion, as for a defence against iniuries; wherefore according to the opinion of *Galen* in the 6. Chapter of his third book *de motu musculorum*, and in the 7. Chapter of his 8. Booke *de usu partium* (who sometime calleth it after the common name of the bowels a

Where is the seat of the vitall faculty.

The heart hath all kinde of fibres.

Paren-

Parenchyma; sometime the fleshy bowell) it is not a muscle, because it hath all kinde of fibres and is not moued with a voluntary motion, for after *Gal.* determination a muscle is the instrument of voluntary motion: but the motion of the heart which dependeth vppon his substance and flesh is not Voluntary but Naturall, neither can cease so long as the creature liueth; but the action of the muscles resteth sometimes and is againe set on woorke according to the determinate purpose of the Creature to wh ch it is obedient. Notwithstanding *Hippocrates* in his Booke *de Corde* calleth it a very strong muscle and not vnwoorthily, for he defineth a muscle to bee flesh rowled into a globe, and such is the flesh of the heart: wherefore both of them resting vpon their own definitions haue deliuered the trueth. And therfore *Picholomenie* answered for *Hippocra.* that there is in vs one motion Naturall whose muscle is the heart; another motion voluntary to which all the other muscles of the bodye are obedient; and he maketh a generall definition of a muscle, that it is a fleshy instrument working motion in a creature: vnder which the heart also may be contayned.

How *Hippoc.* is to be vnderstood when he calleth the heart a muscle.

The perpetuall motion of the heart because of the continuall generation of spirites (because euery part standeth in neede of them) is double consisting of a *Dyastole* or dilatation, and a *Systole* or contraction, which is accomplished by the fibres: for as long as the Creature liueth it is dilated and contracted, and betwixt either of these motions commeth a rest or cessation: for contrary motions, saith the Philosopher, cannot be without a rest between them.

The double motion of the heart.

Contrary motions must haue a rest between the.

It is dilated when the cone or end is drawne to the *basis* with right fibres, and then it becommeth short indeed, but his sides are so distended that it appeareth sphericall or round. The vse of this motion is to drawe bloud into the right ventricle by the hollow veine, and ayre into the left by the venall artery, the values falling downe and giuing way to their entrance: but it is contracted when the cone or poynt departeth from the *basis*, and then the heart becommeth longer indeed but narrower, the right fibres being loosed to their length and the transuerse which encompasse the heart round being strongly gathered together & straightned, the values of the hollow veine and the venall arterie partly shutte, but those of the great artery & the arteriall veine are opened, yeelding out-gate to the bloud out of the right ventricle by the arteriall veine into the Lungs, and to the vitall spirite out of the lefte ventricle into the great artery, and to a portion of the vitall bloud together with the soote through the venall artery. This motion of the heart is called *Systole* or contraction and depression.

How the hart is dilated.

How it is contracted.

This contraction is not a little helped, if not altogether performed, by certayne strong ligaments [table 10. figure 6.[LL] figure 7.[HH]] which are streatched in the inmost parts of the ventricles of the heart; for when these being contracted doe fall, they also drawe together with them the coats of the heart inward.

Ligaments in the heart helpers or authors of contraction.

Finally the oblique fibres which lye obliquely along the length of the hart, are the cause of the small rest that is betweene these contrary motions; and those things whether bloud or spirits, which are drawne into the heart by their helpe are a little while reteyned in the ventricles, the heart being on euery side straightned about those things it contayneth: but if in the diffection of a liuing creature you carefully obserue the motion of the heart, you shall discerne foure motions distinguished by their seuerall times and places, whereof two are proper to the eares of the heart, and two to the ventricles. The cauities of the heart which we call ventricles, *Hippocrates* called γαστέρας *i.* Bellies, so doth *Galen* in the 11. Chapter of his 6. Booke *de vsu partium*, but by a diuerse name χοιλία. They are two very notable differing in largenes and in form.

The rest of the hart how wrought.

4. Motions in the heart distinguished by their times and places.

The right [tab. 10. figure 3.[GG]] is not exactly round, and hath a proper superficiall circumscription of his own, semicircular and crescent like a halfe Moone, for the belly of the partition which is like a semiorbe stands out into it. This sayeth *Hippocrates* compasseth *Caudam cordis*, that is the taile, he meaneth the poynt or cone of the heart, but reacheth not to the very extremity, yet lower sayeth *Vesalius* then the left ventricle doth. It is broader also and larger much then the other, because it is to containe a farre greater quantity of bloud, therefore *Galen* in the 7. and 12. Chapters of his fixt Booke *de vsu partium* and an antient Greeke Physitian of *Ephesus* called *Ruffus*, call it the bloudy ventricle and *venosus*, that is the veiny ventricle. His flesh is more laxe and soft and his partition thinner [tab. 10. figure 5[QR]] in compensation of the waight of that it contayneth, that the heart might not be ouer-ballanced. Into this the ascending hollow veine whileſt the heart is dilated powreth bloud, that in the dennes which are among the fibres of it, it might by the heate of the heart

The right ventricle.

A. The right side of the heart, and a great part of the backe side. B. The right eare of the heart.
C The Hollow veine opening into the heart, from which place Aristotle thought it tooke his originall.
D. sheweth the place where the Hollow-veine passeth through the *Diaphragma* or Midriffe.
E. A part of the *Diaphragma* or Midriffe.
F. The hollow-veine tending to the *Iugulum*.
G. The beginning of the veine *Azygos*
H. The trunk of the great Artery. I wher it descendeth
K. A part of the Nerue of the sixt coniugation, from which the heart getteth a Nerue.
L M N O. the foure Lobes of the Lungs.
P. The way of the Vessels which attaine to the Lungs.
Figure II. A B, C. The left side of the heart, and a great part of his back side.
D the vessels of the heart which compasse his *Basis*.
E The branches of the same vessels.
F The left eare of the heart.
G,H The venal artery, his distribution into the lefte Lung. I The Arteriall veine.
K His branch going to the left Lung,
L His branch going to the right Lung.
M the top of the right eare of the heart.
N N the hollow vein. O the trunk of the great artery
P His descending trunk. R S His ascending trunke
Q the left Axillary artery. T the right axilarie artery
V X The *Carotides* or sleepy arteries cal'd also *Soporariæ*
Y The trunke of the Weazon or rough artery.
a The right nerue of the sixt paire.
b f Certaine branches making the right Recurrent sinnew *f*. *c* the left Nerue of the sixt paire.
d Certaine branches making the Recurrent Nerue.
e A surcle of the same offered to the left Lung.
g The left Recurrent Nerue.
h A small Nerue attaining to the Basis of the Heart.
i,k l,m. The Lobes of the Lungs.
n,o. The Midriffe or *Diaphragma*. *Figure III.*
A C D. Portions of the vessels of the heart.
B. The right eare of the heart.
E The lefte eare of the heart with a part of the Venall artery. F the point of the hart cald the Cone & *Mucro*
GG. the right ventricle of the heart.
HH, The left Ventricle of the heart.
II, The partition called *Septum* which distinguisheth the Ventricles.
Figure 4. and 5. A B, A part of the Hollow-veine from the Midriffe to the *Iugulum*.
CCC. The orifice of the hollow-veine opening into the right Ventricle.
D E The orificies of the descending and ascending hollow veine.
F The rugous or vnequal inside of the right ear of the heart, which is placed in the lefte side, because the heart is dissected through the middest.
G. the beginning of the Crown-veine of the heart.
HHH. A circle bunching out in the orifice of the hollow veine. K L M the 3 Values of the hollow veine
NN The Filaments or Fibres of the Values.
OO Certaine fleshy excrescencies to which these Filaments do grow.
P. A cauity regarding the orifice of the arterial veine.
QR. A part of the hart compassing the right ventricle
Fig VI. A,B A portion of the hollow veine and the great Artery.
C D. the orifice of the arteriall veine, the mouths also of his two branches.
E F G. the three Values or Flood gates.
HH The wal betweene the Ventricles of the heart.
I One of the Values of the Hollow-veine.
K the Filaments of the same
L the fleshy portion to which those Filaments are implanted.
M the right eare of the hart inuerted & hanging down.

Table 10. *Fig*. 1. *sheweth the right side of the heart freed from the Pericardium or purse, which together with the Lungs is reflected to the left side, that the continuity of the Hollowe veine with the heart at his basis might better bee discerned, together with the vessels and a part of the Midriffe.*
Fig. 2. *sheweth the heart turned vpon the right side, that so the left side & the venall Artery with his Nerue might better be discerned.*
Fig. 3. *sheweth the heart cut ouerthwart that the thicknesse of the ventricles might better appeare.*
Fig. 4. *sheweth the bones of the heart as some expresse them.*
Fig. 5. *sheweth the heart freed frō the Lungs & the midriffe, the right ventricle & the orifice of the hollow-veine dissected.*
Fig. 6. *sheweth the heart cut thorough the right ventricle and the orifice of the Arteriall veine.*
Fig. 7. *sheweth the heart cut through the left ventricle, as also the orifice of the venall Artery cut open.*
Fig. 8. *sheweth the heart cut through the left ventricle & the orifice of the great artery.* Tabula X.

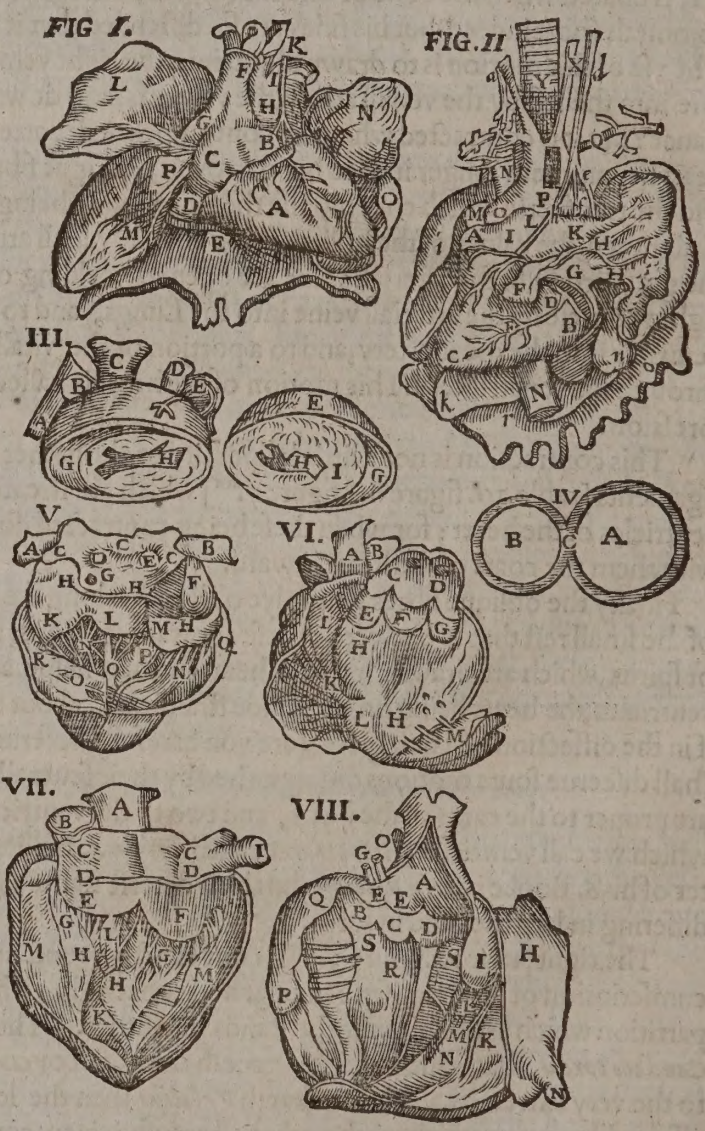


Fig. 7. A the trunke of the great Artery. D A portion of the arteriall veine. CC the orifice of the venal Artery. DD A bunching circle in the same orifice. EF the two Values of the venal artery. GG Filaments drawne downward from the Values. HH the fleshy portions to which they are fastned. I the left eare of the heart turned inward K the wall or partition betwixt the ventricles. L A bosom or cauity reaching the orifice of the great Artery. M M. A portion of the heart compassing the left Ventricle.
Fig. 8. A the orifice of the great artery. B C D, the Values that are set before that Orifice. E F the beginning of the Coronall Arteries, G Portions of the same arteries sh utting foorth H the Orifice of the Venal artery, I K his two Values. L the Filaments of the same. M the fleshy portions to which they grow. N. The left eare of the heart inuerted. O. A portion of the arterial Veyne. P Q. the substance of the heart compassing the left Ventricle. R. the wall betwixt the ventricles of the heart called *Septum*. SS. A certaine substance at the roote of the great Artery which sometimes in Beasts is bony.

heart be reboyled, attenuated and purified, both for the generation of vitall ſpirits, as alſo for the nouriſhment of the Lungs: for the greater part of that bloud in the *Syſtole* or conſtriction of the heart is powred out into the Lungs by the Arteriall veine, but the thinner part ſweateth through the partition into the left vētricle; for this right vētricle was created eſpecially for the Lungs ſake, as being found onely in thoſe creatures which haue Lungs; but in thoſe creatures which doe not reſpire but onely tranſpire as Fiſhes, this right ventricle is not found. And ſo the heart maketh recompence vnto the Lungs ſayeth *Galen* in the 10. chap. of his 6. book *de vſu partium*, which drew in ayre for his behoolfe, by making and ſending them nouriſhment fit for them. Reſpiration & tranſpiration.

The left ventricle [table 10. figure 3. HH] is made iuſt in the middeſt of the heart; if you take away that part which made the right you ſhall better perceiue it. It is narrower then the former, becauſe it is made to contayne a leſſe quantity of matter, and his cauity is rounder, and goeth ſayth *Galen* in the firſt chapter of his 7. booke *de Anatom. Adminiſt.* (though *Veſalius* be of another minde as we haue ſayed) vnto the verie end of the cone. His fleſh or wall is thrice ſo thicke [table 10. fig. 8. RQ] as that of the other, as well becauſe of the ſmalneſſe of his cauity which muſt needs leaue the ſides thicker, as alſo for that it preſerueth the in-bred heate: it is alſo harder and more ſolide to keepe in the vitall ſpirits that they do not exhale or vapour out, and to poyſe the body; the thicknes of this and ſubtilitie of the contents anſwering to the largenes of the other, and thicknes of his contents, that ſo the hart might not incline too much on either ſide. In this the vitall ſpirites are laboured and contayned together with the arteriall bloud, wherefore *Galen* in the 7. and 11. chapters of his ſixt booke *de vſu partium*, and *Ruffus* call it the ſpirituall, others the ſpongie, ayry and arteriall ventricle. The left ventricle. The reaſon of his thicknes. The poyſe of the heart.

For in the cauity of this ventricle the vitall ſpirits are laboured, and from hence by the arteries are diſtributed through the whole body to cheriſh the in-bred heat of the parts, to reuiue it when it growes dull or drowſie, and to reſtore it when it is conſumed. What is contained in it.

The matter of this ſpirite ſayeth *Galen* is double, ayrie and bloudy mingled together. The ayre drawn in by the mouth and the noſe & prepared in the Lungs, is carried through the venall artery into the left ventricle whileſt the heart is dilated. And the bloud attenuated and concocted in the right ventricle, is partly diſtributed into the Lungs by the arterial veine for their nouriſhment, partly is drawne by the left ventricle through his wall and retayned by an in-bred propriety which being mingled with the ayre is abſolued and perfected by the proper vertue of the heart, his in-bred ſpirit, heate and perpetuall motion, and ſo putteth on the forme of a ſpirit, which is continually nouriſhed by the arteriall bloud. This bloud thus fraught with ſpirits in the contraction of the heart is powred out into the great artery to ſuſtayne the life of the whole body; for all life is from the heart and the vitall ſpirite. The matter of the vital ſpirit.

The inward face of both the ventricles is vnequall and rugged, that the ſubſtances which come into the heart ſhould not ſlippe out before they are perfected, for which purpoſe alſo the values doe ſtand in great ſtead. The inward ſuperficies of the ventricles

That inequality commeth partly by reaſon of many ſmall dennes which are more notable in the left ventricle, (wherefore *Hippocrates* in his booke *de Corde*, ſayeth it is more broken and abrupt then the right, becauſe here Nature hid the diuine fire which the Poets feyne *Prometheus* ſtole from heauen to giue life vnto man: and *Hippocrates* becauſe of the great heat of this place thought it to be the ſeate of the Soule) partly becauſe there are certaine ſmall fleſhy particles [table 10. figure 5. OO figure 6. L figure HH figure 8. M table 12. fig. 2. ff] which about the cone of the heart appeare ſmall & ſlender, to which the neruous fibres of the values [table 10. figure 7. GG figure 8. I] called by *Galen* in the 8. Chapter of his 6. Booke *de vſu partium*, and by *Archangelus* the ligaments of the heart, do grow. Whence the inequality is. *Prometheus* fire

Theſe ventricles are diuided by a wall or partition [table 10. figure 3. K figure 6. HH figure 7. K figure 8. K] leaſt the contents ſhould bee mingled and ſhufled together, which on the right ſide beareth out as we ſayed and is gibbous; on the left concaue and hollow, and is of the ſame thickneſſe with the left ſide of the left ventricle, as if the heart were only made for the left ventricles ſake. The wall of the ventricles

This wall is alſo full of holes and ſmall trenches (it may be *Ariſtotle* therefore called it a third ventricle) that in them the bloud might be wrought into a further thinneſſe; porous alſo it is eſpecially on the right ſide, that the bloud might more freely paſſe out of the right into the left ſide for the generation of vital ſpirits, which *Galen* inſinuateth in theſe words, in

the 15. Chapter of his third booke *de Naturalibus facultatibus*. *Out of the right cauity that which is thinneſt is drawne by the pores of the wall*, whoſe vtmoſt ends a man can ſcarce diſcerne, becauſe in dead bodies all ſuch paſſages fall together. That the bloud is carried by theſe paſſages it appeareth becauſe nature neuer endeuoured any thing raſhly or in veine; but there are many trenches as it were and deep caues in the partition which haue narrow determinations. Thus far *Galen*.

How beſt diſterned.

The opinion of ſome learned men.

Theſe breathing paſſages are moſt conſpicuous in an Oxe heart after it is long ſodden. But there are ſome as *Varolius*, *Columbus* and *Vlmus*, who deny that there is any ſuch paſſage, and wil that the bloud ſhould be carried by the arteriall veine out of the right ventricle into the Lungs, part of which to remayne for their nouriſhment, and the remaydner to be conuayed after ſome alteration in the Lungs mingled with the ayre which is drawne by the breath through the venall artery into the left ventricle of the heart for the nouriſhment and generation of the vitall bloud and ſpirits.

But wee will leaue this ſubtle queſtion to Philoſophers, for vs it ſhall bee ſufficient to haue made this mention of both waies by which it may paſſe, leauing the Controuerſie to farther diſquiſition.

The deafe-eares.

At the Baſis of the heart on either ſide hangeth an appendixe [Table 9. figure 2.[IX] tab. 10. figure 3.[BB]] which is called the Eare, not from any profite, action or vſe it hath ſayeth *Galen* in the fifteenth Chapter of his ſixt Booke *de vſu partium*, and therefore wee in Engliſh call it commonly the deafe-eare, but for the ſimilitude; for it hath a long Baſis and endeth in an obtuſe or blunt cone or poynt.

Their ſcituation.

The right.

The left.

Theſe are placed about the ventricles before the orifices or entrances of the veſſels which carry matter into the heart. The right [Table 9. figure 2.[I] table 10. figure 1.[B] fig. 3.[E]] which is placed neare [table 10. figure 3.[A]] the hollow veine is the larger, and maketh as it weere a common body together with the veine, and his cone or poynt looketh vpward. But the left [Table 10. figure 2.[F] figure 3.[E]] placed at the arteriall veine [Table 10. figure 3.[D]] is much leſſe, becauſe the orifice of this veſſell is much leſſe then that of the hollow vein, and beſide ayre followeth more freely at a narrow paſſage then bloud.

Why the ears haue correſpondency with the ventricles.

It is alſo ſharper and runs more on the ſide of the heart and is more rugged and vneuen on the outſide then the right, harder alſo and more fleſhy and thicker, for the eares haue a correſpondency with the ventricles, as ſeeming to bee by Nature framed to bee aſsiſtant in ſome preparation of the matters which belong to the heart. They are hollow as making way vnto the heart.

Their ſubſtance is peculiar and ſuch as is found in no other parte; much like the ſcarffe-skinne, and membranous that they might endure the force of attraction without breaking, and alſo that they might better follow the motion of the hart; for they are like values ſtretched and contracted; when they are full and extended then are they gibbous and ſmooth,

Their figure

but when they are contracted then they appeare outwardly rugous and wrinkled, and with in they reſemble the vnequall *ſuperficies* [Tab. 10. figure 5. the right inuerted[I] rugous fig. 7. the left inuerted 1. fig. 8.[N]] of the ventricles.

Subſtance.

They are thin that they might more eaſily be contracted, ſoft, and neruous for ſtrength for that is ſtrongeſt which is moſt ſinewy.

Their vſe.

The vſe of theſe eares is that whereas the bloud and ayre ruſh violently toward the heart theſe ſhould take them vp by the way, and keepe them as in a ſafe and let them into the heart by degrees, otherwiſe the creature ſhould bee in danger of ſuffocation and the heart of violence in their ſudden affluence. Moreouer they defend the veſſelles to which they are ſet in the motions of the heart which haue a ſoft and thinne coate, and therefore other wiſe when they are ſtreatched in ſudden repletion might be ſubiect to cracke or burſt. *Hippocrates* ſayd they ſerued the heart as fannes to coole it, or as bellowes to ſmithes forges to gather in the ſpirits as they gather in wind.

CHAP. XIII. *Of the veſſels of the Heart and their values.*

4. veſſels.

There are ſeene about the Baſis of the heart in the outward ſides of the ventricles foure veſſelles and ſo many orificies, whoſe originall ſome woulde deriue from the heart, as *Veſalius* and *Varolius*, and they are in each ventricle two. *Hippocrates* in his Booke *de Corde* calleth them the fountayns of humane Nature.

Their poſitiō.

In the right the hollow veine [Table 9. figure 2.[F] Table 10. figure 1. C figure 2.[NN]] and the arteriall veine. [table 9. fig. 2.[G]] In the left the venall artery [table 10. fig. 2 [GH]]

and

and the great artery. [Table 9. figure 2. [n] Table 10. figure 1. [n] figure 2. [op]] Within these vesselles are certaine values or leafe-gates placed, which *Hippocrates* called the secret filmes of the heart, and *Galen* membranes and the *Epiphysis* of membranes eleuen in number, all arising from the orificies of the vesselles. Some of these are three-forcked, some like halfe Moones: some againe are carried from without inward into the ventricles of the heart, to which they are tyed with strong membranes, especially to the partition toward the cone or poynt, that in the dilatation of the heart the ligaments might draw the values vnto them selues, and as it were turne them vp to the body of the heart: others are carried from an inward position outward, as soone as the two vesselles do peepe out of the heart. In those vesselles which receiue matter into the heart they are strong, because they are not onely to hinder the regresse but also are to drawe; but in those that send out matter out of the heart, they are weaker.

The values. 11. in number. Their forme. *Foras intus.* *Intus foras.* Where stronger and why.

In the dilatation of the heart they are all extended, the forked values making certain gaping fissures betweene their forkes, by which the matters are let in; those like the halfe-Moone or the semicircular values doe shut close the endes of their vesselles and so hinder those matters that are gone out for returning in againe.

The works of the values in dilatation.

In the contraction of the heart they are all likewise contracted, & then the forked ones do close vp those yawning fissures which they made in their dilatation and so hinder those matters that are gone out for returning in againe. These circular values flagging to the sides of the vessels doe leaue open way for the bloud and spirits to issue out. Of these values *Hippocrates* made first mention, and extolleth their structure as a wonderfull secret of Nature, and they are sayeth *Galen* in the 11. Chapter of his sixt Booke *de vsu partium*. framed with such exquisite Art that if they bee all at once streatched and stand vpright, then they stop the whole orifice of the vessell.

In contractio. *Hip.* first mentioned them.

They haue all one common vse which is to hinder that which is gotten into the heart for passing out againe. They haue also proper vses, the vse of those that are set within and goe outward, is to leade out matters out of the heart and not suffer them to come back: the vse of those that are set without and goe inward, is to keepe the matters gotten in, that they get not out againe, and both these that the labour of the heart should not be in vaine.

Their vse common. Proper.

But because the constitution of these vessels is one in the heart of an Infant whilest it is in the wombe, and another in the heart after the birth, wee will intreat of them seuerally. And first as they are in a man after he is borne into the world.

The hollow veine hauing perforated [Table 10. figure 1. [p] figure 2. [nn] sheweth the passage of the veine] the midriffe, and being come vnto the hearte first sending out a short braunch from his lefte side, is receiued by the right deafe-eare with his ample and patent orifice [Table 10. figure 1. from [c] to [s]] thrice as large as the orifice of the great artery, and is presently inserted into the right [Table 10. figure 5. CC sheweth his orifice] ventricle; to which it adhereth so firmely that vnneth it can be separated from it. Whence came the occasion of *Aristotles* error and his followers, who thinke that there the hollow veine [tab. 10. figure 1. C] as also all the rest haue their originall. And for the strengthening of the heart, this great braunch becomes like a ligament, and his vse is to bring the bloud which is sent vpward from the Liuer vnto the right ventricle and there to powre it into the heart whilest it is dilated, to bee farther attenuated therein, as well for the nourishment of the Lungs which require a thinner bloud, as especially for matter to make the arteriall bloud and spirites afterward to bee perfected in the left ventricle. The greater part of which is afterward sent out in the contraction of the heart by the arteriall veine [Table 10. figure 5. P.]

Of the hollow veine in the heart.

To this orifice groweth a membranous [Table 10. figure 5. HH] circle, which addeth strength to the heart, it passeth inward and not farre from the beginning is diuided or slitte into three small but strong portall membranes [Table 10. figure 5. [KLM]] or values whose Basis is large, and they end in an obtuse or dull poynt, and when they are shutte and doe as it were wincke together, they are like broade headed Iaulins or broade arrowe heades triangular, and euery angle forked; all which forks consist and growe together of small threds of fibres [Table 10. figure 5. [nn]] (which *Aristotle* mistooke for nerues) ioyned together with fleshy breaches, [Table 10. figure 5. [oo]] which by those fibres as by ligaments are stretched in the contraction of the heart, and those being streatched the orifice is almost cleane shut vp. But when this circle is open together with his fibres it resembleth a Crowne such as Princes in old time wore.

The circular membrane. Breaches.

But theſe Values, as alſo thoſe of the venall Artery doe encline from without inwarde, that the bloode in the contraction of the heart ſhould not regurgitate into the Hollowe-veine: how then is it poſſible that blood ſhould bee laboured in the heart for the nouriſhment of the whole body when as no blood can paſſe out of this Ventricle into the hollow veine but onely into the Lungs? Wherfore it was neceſſary that Nature ſhould prouide a way out of the Lungs into the hollow vein, from whence branches might be diſperſed thoroughout the whole body.

The Arteriall Veine.

A veine by office.

An artery by ſubſtance.

his Originall.

Archangelus his argument.

The other Veſſell of the right Ventricle is the Arteriall Veine [Tab.9.figure 2 [c]. Tab.10, figure 6 [c D] Tab.11, figure 1 C] or the arteriall veſſell. A veine it is, becauſe of the office it hath to tranſport blood, an artery becauſe his frame and ſubſtance is like that of an arterie. It is faſtned to the ventricle with a leſſe orifice [Tab.10, figure 6, [c D]] then the hollow vein, [Tab.10, figure 5, CCC] and from thence ſome ſay it hath his originall, yet it may better be imagined to be a branch and off-ſpring of the great arterie, becauſe (as ſaith *Archangelus*) it is moſt likely that a veine ſhould come from a veine, and an artery from an arterie; therefore the Venall artery, which though it haue the vſe of an Artery, yet hauing the ſingle coate but of a veine hath his Originall from the Hollow-veine made alſo of one ſingle coat. And ſo the arteriall veine hauing the vſe of a veine but the double coat of an arterie, moſt likely proceedeth from the great arterie which hath a double coate. Of which opinion alſo are *Varolius* and *Laurentius*, & it is further confirmed by their Connexion which in the Infant vnborne is more conſpicuous.

The true original of the arterial veine

The vſe of the ſingle coat of this Arterie.

But the verie trueth as I conceiue is, that it ariſeth as other ſpermaticall parts do from the ſeede. His coate is not ſimple as that of a veine, but double [Tab.11, fig.3. [B C]] as an arterie, and that for the vſe as well of the Infant in the wombe as of the man afterward; of the Infant, that the Mothers arteriall blood and vitall ſpirit which it carrieth into the Lunges, dooing therein the office of an arterie, ſhould not breath out as it would if it were as thin as a veine: of the man afterward (and in him it dooth onely the dutie of a veine, not of an arterie) partly becauſe in reſpirations it was not fit it ſhould bee eaſily dilated and contracted, as it would haue beene if it had had the ſingle coate of a veine, for then there would not haue beene capacitie ſufficient in the Cheſt for the inſtruments of breathing, and beſide the blood ſhould haue had too free and full acceſſe to the heart; partly, becauſe the Lungs which are of a ſpongy and light ſubſtance required to be nouriſhed with a thinne and vaporous not with a thicke and craſſe bloode (for euery thing is nouriſhed with aliment likeſt vnto it ſelfe) which could not haue beene either ſo prepared or ſo conteined in a veſſell with a ſingle coate, as in one with a double.

Hip. his good vſe of this ſingle coate.

Wee will add alſo that cauſe whereof *Hippocrates* maketh mention, that is, that the right ventricle which is not ſo hot as the left, might not be as much cooled as the lefte, and ſo at length his heate extinguiſhed. For ſeeing that the branches of the Weazon which drawe in the cold aer are diuided betweene the branches of the arteriall veine and venall atterie, [Tab.11, figure 1, [B C D]] if the coate of the arteriall veine were but one, it would receyue as much aer as the venall artery whoſe coate likewiſe is but one, and ſo both ventricles ſhould be alike refrigerated; whence it muſt needes follow, that the lefte hauing more heate then the right, the heat of the right muſt of neceſſity be in time extinguiſhed, the heat of the left remaining inviolate; wherefore Nature made this veſſell thicker and ſo narrower, to carry aer not ſo much for refrigeration as for refection.

This is a verie notabl veſſell, that ſo much as it becommeth leſſe by the thickeneſſe of his coates, might be recompenced in the largeneſſe of the Veſſell, and ſo the Lunges haue ſufficient nouriſhment.

his amplitude

His diuiſion.

It leaneth vpon the great Arterie, and turning his bulke vnto the left ſide, is diuided into two [Table 10, figure 6, [C D]. Tab. 11, figure 3 [F F]] trunkes which are carried to the lefte and the right Lungs, and there diſtributed quite through into inumerable [Tab.11, Fig.3, [G G]] branches.

His Vſe

The vſe of this veſſell is in the contraction of the heart, to receyue the greater part of the blood out of the right Ventricle (in which it is made thinner and lighter, that it might paſſe out more forcibly) and to carry it into the Lunges for their nouriſhment. For the heart ſeemeth to make retribution to the Lunges, yeelding them bloode for their nouriſhment, becauſe they ſent aer vnto him for his refection.

But although this Veine was made thicke and hard, that it might not too eaſilie be either contracted or dilated, yet it is not ſo hard, but that his branches are contracted & dilated

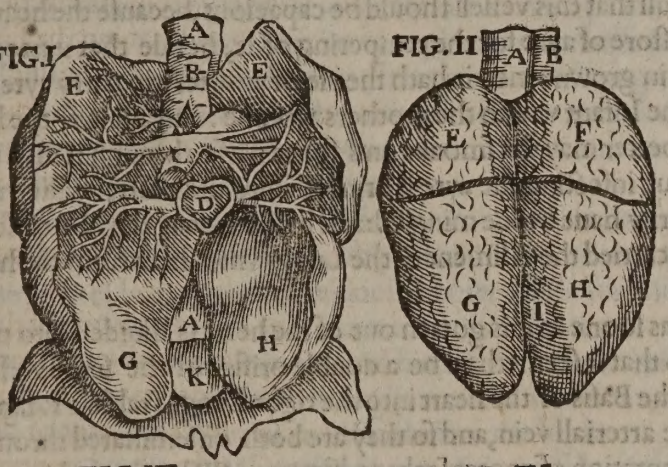
Table 11. *Figure* 1. *sheweth the fore-side of the Lungs taken out out of the Chest, from which the Heart with his Membranes are cut.*

Fig. 2. *sheweth the backe and gibbous side of the Lunges, as it lyeth vpon the backe.*

Figure 3. *Sheweth the Arteriall Veine.*

Figure 4. *Sheweth the Venall Arterie separated from the substance of the Lungs.*

TABVLA XI.



A A, 1,2. The Gullet called *æsophagus* vnder the wezon or Rough arterie.
B 1,2. The rough artery.
C 1, The arteriall veine.
D 1. The venall artery.
E F G H, 1,2. The foure Lobes of the Lungs.
K, 1 The Midriffe.
I, 2. The Canale or pipe of the Lungs.
A 3. The Orifice of the arteriall veine.
abc, 3. His three Values.
B 3. The inner Coate.
C 3. The vtter coate
D 3. The diuision of the arteriall veine.
E F. 3. The two Trunkes whereinto it is diuided.
GGGG 3. The distribution of the same through the substaunce of the Lungs.
A, BB, CC 4. The orifice of the venall Arterie, marked with A. where it groweth to the heart, then diuided into foure trunkes.
EEEE 4. Their distribution through the Lunges
F 4. The simple or single coate of this artery.

lated by the chest; and so in the next dilatation of the heart the blood must needes returne into the heart by the same way it came out; but against this inconuenience prouision is made by three Values [Tab. 10, figure 6, ABC] which are set to the Orifice of this trunk where it swelleth a little.

These Values haue their Originall from the very coate of the Veine, and beeing placed inward do looke outwarde, and each of them is like a semi-circle or halfe-moone, or the Latine Letter *C*. If all these three be together stretched and set vpright, they seeme to bee but one great Value stopping vp the whole Orifice, & whilst they are stretched carry their Figure of the halfe-Moone; but when they sinke or flagge then they become rugous and resemble the Moone in the first quarter. Whence the Values are. Their figure.

Their outward Couering or Circūference, as also is that of the great Artery, is more solid then the rest of their body; for where in both Orificies they touch themselues or ioyn some way together, they become so indurated, that they appeare to bee like a long and rounde tilage. The Vtter coate of this Vessel.

The Venall artery [Tab. 10, fig. 2 GH not rightly expressed Table 11, fig. 1, D] is a vessell of the left Ventricle. An artery because of his vse, for it containeth and bringeth aer, as also because it beateth as other Pulses doe; not so indeede that it can bee discerned The venal arteries.

It hath pulſation though not viſible.

by the eye; but ſo it muſt of neceſsity bee, becauſe it is continuated with the left ventricle where is the originall of pulſation. A veine it is as being of the ſubſtance that veines are of.

It proceedeth out of the left ventricle of the heart at his Baſis with a ſpacious & round & open orifice [table 10. figure 7. [cc]] greater then that of the great artery. It is ſuppoſed to haue his beginning out of the ſofter part of the ventricle; but it may better be beleeued to haue ſprong out of the hollow veine if wee marke the connexion that is found in Infants vnborne.

His coate but ſingle.

It hath but one thinne and ſimple coate in growne bodies, that the Lungs might bee nouriſhed with defæcated thinne and vaporous bloud brought by it but ſent by the heart, and that in a greater quantity then a thick ſtiffe veſſell would carry: becauſe the Lungs are parts of great expence as well becauſe of their continuall motion, as alſo for the rareneſſe and looſeneſſe of their ſubſtance which ſuffereth the thinnet part of the bloud to exhale from them: againe it was needfull that this veſſell ſhould be capacious, becauſe the heat of the left ventricle required great ſtore of ayre for the tempering of it, beſide that it needed for the reparation of ſpirits: for in growne men it hath the vſe of an artery to carry ayre, & not of a veine as it had whileſt the Infant was in the mothers wombe: and againe, the larger it is and more ſpacious the better may the ſmoake and ſoote paſſe through it into the braunches of the weazon without infecting the ayre it brinketh into the heart, which in a narrower paſſage would neceſſarily haue beene mingled: and in the Infant it had no vſe of a double coate becauſe it onely carried the Aliment of the Lungs vnto them from the hollow veine.

Why this veſſel is to be capacious, many reaſons.

It is a notable veſſell, and as ſoone as it is gotten out of the heart is diuided into two trunks [table 11. figure 4. [BBCD]] ſo that it ſeemeth to be a double orifice of the ſame veſſell. The right of theſe is ſent vnder the Baſis of the heart into the right Lung, [table 11. figure 1. [D]] The left into the left like the arteriall vein, and ſo they are both diſſeminated through the Lungs, and make the repreſentation of rootes [tab. 11. figure 4. [ZZZZ]] and may be compared to the rootes of the gate-veine: for as it doth ſucke the nouriſhment with his ends or extremities, ſo the venall artery is deriued into the Lungs to draw ayre out of the braunches of the weazon. But at the originall of this veſſell and the great artery, they both meete and are ioyned together, by the interpoſition of a good thicke and large particle which in the Infant was perforated and made a paſſage as we ſhall declare hereafter. The vſe of this venal artery is in the dilatation of the heart to draw ayre out of the Lungs for the generation of ſpirits, and in his contraction to expell or drawe out into the Lungs a portion of the vitall bloud for their nouriſhment and life, as alſo the ſoote and ſmoake that ariſeth from the flame of the heart: but leaſt all the ayre ſhould returne again out of the hart into the Lungs, there groweth to the orifice of this veſſell a membranous circle [table 10. figure 7. [DD]] out of the ſubſtance of the heart, which is ledde inward and deuided into two values [table 10. figure 7. [FF] table 12. fig. 2. [f]] bending from without inward; which as they exceede in largenes the values of the hollow veine, ſo alſo they are ſtronger, hauing longer thredy ſtrings [Table 10. figure 7. [GG]] to which more fleſhy [Table 10. figure 7. [HH] table 12. figure 2 [ff]] explantations or riſings do accrew; one of theſe values looketh to the right ſide another to the left, which when they are ioyned do reſemble a Biſhops myter.

The right branch.

The Left.

The vſe of the venal artery.

His values.

Why but two

They are but two becauſe this veſſell was not to be ouer cloſely ſhut and that for two cauſes: firſt, ſeeing that all parts need vitall ſpirits and bloud to be ſent vnto them for their life the Lungs alſo muſt neede them; wherefore as they receiued Alimentary and nouriſhing bloud by the arteriall veine, ſo were they to receiue vitall by the venall artery; therefore in the venall artery there is alwayes contayned ſubtile and arterial bloud, which that it may be, it hath onely two values ſet to it, that in the contraction of the heart the way might not be altogether ſtopped vp, but ſo much ſpace lefte as was neceſſary for the tranſvection of vitall bloud.

The neceſſity of them.

But if the values were wanting then would the arteriall bloud in contraction flow forth in greater quantity and with more violence, and ſo the great artery and conſequently the whole body ſhould be defrauded. Againe, that if there ſhould bee any ſmouldry excrements ingendred betweene the ayre attracted and the natiue heate which is conteyned in this ventricle, they might haue free egreſſe this way into the Lungs and ſo goe out by the weazon; which otherwiſe if they were retayned might endanger the ſuffocation and extinction of the creatures naturall heate.

The

The ſecond veſſell of the left ventricle is the great artery, of which though wee doe entreat at large in his proper place, yet it will be neceſſary to diſcourſe of it here ſo far as ſhall make for out preſent purpoſe.

CHAP. XIIII. *Of the great Artery and his values and vſe about the Heart.*

THis great Artery called *Aorta* was made before the heart, hauing as the heart a beginning of generation from the ſeed, out of which it is immediately made at the ſame time that the other parts are. Albeit his originall of diſpenſation and radication be from the left ventricle of the heart, from whence it iſſueth with an open mouth and patent orifice to receiue from the ſame when it is contracted bloud and vitall ſpirit laboured in it to be diſtributed together with the heat into the whole body. Which bloud and ſpirits that they ſhould not returne into the heart againe when it is dilated there are ſet in his orifice [Table 10. figure 8.^{A}] three [Table 10. figure 8.^{BCD}. Table 13. character 1.2.3] values like halfe Moones bending from within outward as it is in the arteriall veine, but greater and ſtronger becauſe the body of the great artery is harder then that of the arteriall veine: theſe values are alſo a hinderance that the nouriſhment or Chylus drawne by the meſaraicke arteries out of the guttes ſhould not be preſently conuayed into the heart.

The great artery.

His values.

There is alſo placed at his orifice to eſtabliſh him the better, a hard ſubſtance ſometimes griſtlely, [Table 10. figure 8. SS] which in ſome Creatures are red Deere is a very griſtle, ſometimes in greater creatures it is a bony griſtle for it ſeldome growes into a very bone, as *Galen* ſayeth in the 10. Chapter of his 7. Booke *de Adminiſt. Anatom* it doth in an Elephant: but in a man it is not ſo to bee found. And theſe are the particles of the heart in a perfect Creature after it is brought into the world: nowe it followeth that we ſpeake of the veſſels in the heart of an Infant before the birth.

The cartilage

Or bone.

CHAP. XV. *Of the vnion of the veſſelles of the heart in the Infant vnborne which is aboliſhed after they come into the world.*

THE ſtructure and connexion of the veſſels of the heart in an Infant vnborne or any other creature yet in the Dammes belly differeth much from that it appeareth to be afterward when the burthen is brought into the world. This *Galen* moſt perfectly and manifeſtly explayned in the 10. Chapter of his ſixt Booke *de vſu partium*. And albeit moſt Anatomiſts after him haue lightly paſſed it ouer, yet will we ſtand ſomewhat more vppon it.

Galen the true obſeruer of theſe vnions.

We ſayed before that there were foure veſſels of the heart, two in the right ventricle, to wit, the hollow veine [Table 12. figure 1,2,3.^{ab}] and the arteriall veine [Table 12. fig. 1.^{m}] and two in the left, the great Arterie [Table 12. fig. 1 2, and 3.^{df}] and the venal artery: [Table 12. figure 1 2, and 3. which in the ſecond figure is manifeſt] which veſſels in the Infant are ſo vnited and coupled two & two together. The hollow veine a veſſell of the right ventricle, with the venall artery a veſſell of the left ventricle: and the great Artery a veſſell of the left ventricle with the arteriall veine a veſſell of the right ventricle: which veſſels in men after they are borne are diſioyned aſunder.

How the vnions are made

But theſe vnitings are not alwayes after one manner: for the former, partly becauſe of the neighbour-hood of the veſſels, partly becauſe of the likeneſſe of ſubſtances they being both veines, is accompliſhed by the coniunction of their mouthes called *Anaſtomoſis*, wee call it inoculation from the ſimilitude it hath with that poynt of husbandry where a ſcience or but a leafe is ſo fitted to another kinde as that the ſap may runne equally through them both.

The former.

The latter vnion becauſe of the diſtance of the veſſels to be vnited is accompliſhed by a Canale or Pipe. The firſt vnion which is by *Anaſtomoſis* or inoculation or apertion and opening of two veſſels one into another, is of the hollow veine with the venall artery [tab. 12. fig. 1, & 2.^{ag}] which is to be obſerued vnder the right eare of the hart before the hollow veine open it ſelfe into the right ventricle [Table 12. figure 2. appeareth at ^{h}] and near that region where the coronall veine ariſeth.

The latter.

For touching one another ſo that you may eaſily thinke them to be but one veſſell, Nature bored them with one hole common to them both [Table 12.^{agh}] which is large and patent and of an ouall figure by which the bloud paſſeth out of the hollow veine into the venall artery and ſo is carried to the Lungs. But leaſt the bloud ſhould flowe backe into the

Their common bore or hole.

The membrane.

the hollow vein there is ſet to the regiõ of this bore or hole which looketh toward the venal artery, a membrane like a couering or lid [Table 12. figure 2. and 3, 1.] thin, hard and tranſparent, larger then the hole or paſſage which is faſtned onely at the roote; but the reſt of the body of it hangeth looſe in the cauity of the veſſell, that falling looſely and flagging into it ſelfe it might the more eaſily bee turned vp to the veſſell of the Lungs. *i.* the venall artery and giue way to the bloud flowing forcibly out of the hollow veine; but hindering it from returning thither againe. Wherefore the venall artery in the Infant doeth the office of a veine to the Lungs, but after the birth the office of an artery; for in theſe whileſt the heart is dilated the bloud is powred out of the hollow veine into the right ventricle, and from thence when the heart is contracted thruſt out by the arteriall veine into the Lungs. But in the Infant the heart being not moued and yet the Lungs requiring nouriſhment & encreaſe, Nature deuiſed the former way by which the bloud brought vppe by the hollow veine is not powred into the ventricle of the heart, ſeeing neither the Lungs ſtood in need of attenuated bloud, neither was there any generation of vitall ſpirites, but runneth ſtraight into the venall artery and thence into the Lungs.

The vſe of the venal artery in the infant.

In the child after-birth.

The admirable works of God.

Theſe are admirable workes of Nature, but the conglutination or ioyning together of the foreſayd hole preſently after, paſſeth all admiration; for as ſoone as euer the creature is borne into the world, breatheth and the heart is mooued, it hath no further neede of this hole or paſſage, wherefore by degrees the membrane is dryed vp and the bore cloſeth and groweth together, ſo that if you looke for it a few weekes after either in the heart of an Infant or of a Calfe, you would deny that euer it was perforated, but in dryer creatures it ſooner groweth vp, in moyſter creatures later.

The 2. vnion by a pipe.

The other vnion is of the great artery with the arterial veine [Tab. 12. figure 1, 2 and 3 ^{g}] by a canale or pipe [Table 12. figure 1 ^{l}] for ſeeing the venall artery performed the office of a veine to the Lungs, it was neceſſary that the arteriall veine ſhould chaunge his vſe into that of an artery: wherefore Nature alſo made a perforation into the great artery. But becauſe theſe two veſſelles were a little diſtant one from the other [Table 12. figure 1. ^{dm}] ſhe made another third veſſell but very ſmall by which they might bee ioyned, ſo that they are ioyned not by inoculation but by a pipe or canale.

Where the pipe beginneth.

This canall or pipe beginneth [Table 12. figure 1. ^{l}] not from the trunke or ſtocke of the great artery, but from that region of the trunke carried downward [Table 12. figure 1, 2, & 3. ^{f}] where the left nerue of the ſixt payre or coniugation making the Recurrent is circumvolued or rowled about, & the pipe paſſeth not ouerthwart but obliquely or ſidelong from the great artery [Table 12. figure 1. from ^{d} to ^{m}] to the arteriall veine, where it is deuided into two trunkes and appeareth as if the arteriall veine were deuided into three trunkes, of which the firſt paſſed vnto the left Lung, the ſecond vnto the right, and the third (which is a little leſſe then the other two) ſhould obliquely reach vnto the great artery, and is from the Baſis of the heart in an Infant diſtant about the breadth of two fingers, in a grown child after birth the breadth of foure: and the longitude of it is ſo notable that you may put vp your finger betweene the two veſſelles, but in Oxen you may eaſily put vp two fingers or more.

Why it hath no membrane or couer as the former perforation hath.

This canale or pipe or veſſell call it which you pleaſe, hath no membrane ioyned to it which might hinder the regreſſe of the bloud out of the great artery into the arterial veine, becauſe the length and obliquity of the pipe it ſelfe is ſufficient for that purpoſe. This canale or pipe is not encreaſed as other parts of the creature are, but as Nature drieth vp the vmbilicall or nauel-veine & arteries which are at the ſpine when ſhee hath no further vſe of them and maketh of them ſmall tyes; after the ſame manner the forenamed coniunctions of the veſſels which reach vnto the heart when the creatures is brought forth are aboliſhed, & this pipe is by degrees attenuated ſo that in a ſhort time it is quite dryed vp. But in children of three or foure yeares of age it may be found, becauſe of the thickneſſe of his roote, but not perforated or hollow.

The vſe of theſe conjunctions.

Theſe vnions or coniunctions are made for the behoofe of the lungs that they might be formed, growe and encreaſe; and therefore the pure bloud of the mother is carried out of the hollow veine directly by the venall artery into the Lungs by inoculation for their generation: for they are formed at the ſame time with the heart, & being generated and formed they are nouriſhed by the ſame matter, and encreaſed as long as the burthen is carried in the wombe: but the vitall ſpirit is miniſtred to the great artery together with the mothers arteriall bloud from the vmbilicall arteries, and from thence are carried into the Lungs to

pre-

Table 12. in 3. Figures, *ſheweth the vnion of the veſſels of the heart, as it is found in the Infant, but aboliſhed ſoon after it is brought into the world.*

TABVLA. XII

FIG. I.

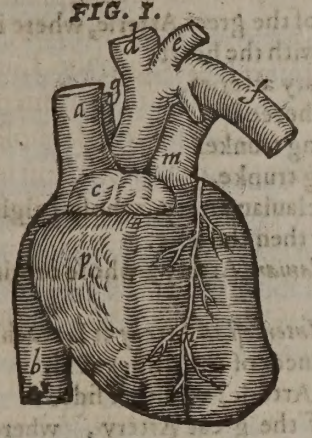
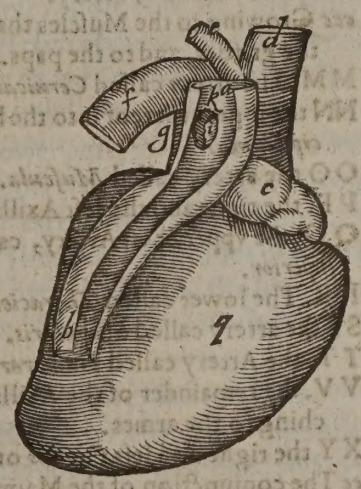


FIG. II.

FIG. III.



a 1,2,3. The aſcending Trunke of the hollow-veine.
b 1,2,3. The deſcending trunke of the hollow-veine.
c 1,3. The eare of the right Ventricle.
d 1,2,3. The aſcending Trunke of the great artery.
e 1,2,3. The left axillarie artery.
f 1,2,3. The deſcending Trunke of the great artery.
g 1,2,3. The Venal artery which in the ſecond figure is open.
h 2. The *Anaſtomoſis* or inoculation, as it appeareth in the venall artery.
i 2,3. A ſmall Membrane like a Value, cloſing vp the hole of the inoculation.
k 3. The inoculation as it appeareth in the Hollow-veine.
l 1. A Canall reaching into the arterial veine, from the deſcending Trunke of the great artery.
m 1. The arteriall veine lifted vpward, from the right ventricle to the Lungs
n 1. Veines and arteries diſperſed thorough the coate of the heart.
o 2. the left ventricle of the hart opened
p 1. The fore-part of the heart vvhich regardeth the Lungs.
q 3. The backe-part of the heart, regarding the Spondels or rack-bones.
r 2. the values of the venall Arterie, with his Filaments.
ſ 2. The fleſhye implantations of the ſame.

preſerue their life through the Canale or pipe by the arteriall veine. Wherefore the vſe of the coniunction is, that whilſt the Naturall and vitall blood is tranſported vnto the Lungs, it might not fall into the ventricles of the heart; for becauſe the heart is not moued it would remaine there, and ſo ſhould the Lungs be defrauded; but when the creature is come into the world, it vſeth no more of the mothers blood but his owne, where it cannot holde the ſame courſe; but it muſt fall into the heart, and there as afore is ſhewed muſt bee changed. But it ſhall not be amiſſe to relate the order of Anatomicall adminiſtration for the finding of theſe vnions.

The firſt vnion which is by inoculation, doth elegantly appeare, if the Trunk of the Hollow-veine carried through the Cheſt from the Midriffe vnto the right eare of the heart bee diuided in the middeſt, for then will appeare two holes or paſſages; the greater which is that of the inoculation into the venall artery, and the leſſer which is the hole or paſſage of the coronary veine of the heart. But the ſecond vnion which is by the Canale or pipe is demonſtrated, if the deſcending trunke of the great Arterie be diuided thorough the middeſt euen vnto his outgate out of the left ventricle of the heart, for then withinwarde will appeare the ſmall and narrow paſſage of the pipe into the arteriall veine.

How to finde out theſe vnions in diſſection.

CHAP

CHAP. XVI. *Of the Branches of the great Artery diſſeminated through the Cheſt and the Necke.*

THE great Artery is the largeſt [Tab. 13, figure 1 A] at the left ventricle of the heart whence it ariſeth, and before it fall from the *Pericardium* or purſe it bringeth foorth aboue his Values or Membranes [Tab. 13, fig. 3, character 1,2,3] ſometimes one, ſometimes two Arteries, which we call *Coronarias*, [Tab. 13, fig. 1, BB] becauſe like a crowne they compaſſe the *Baſis* of the

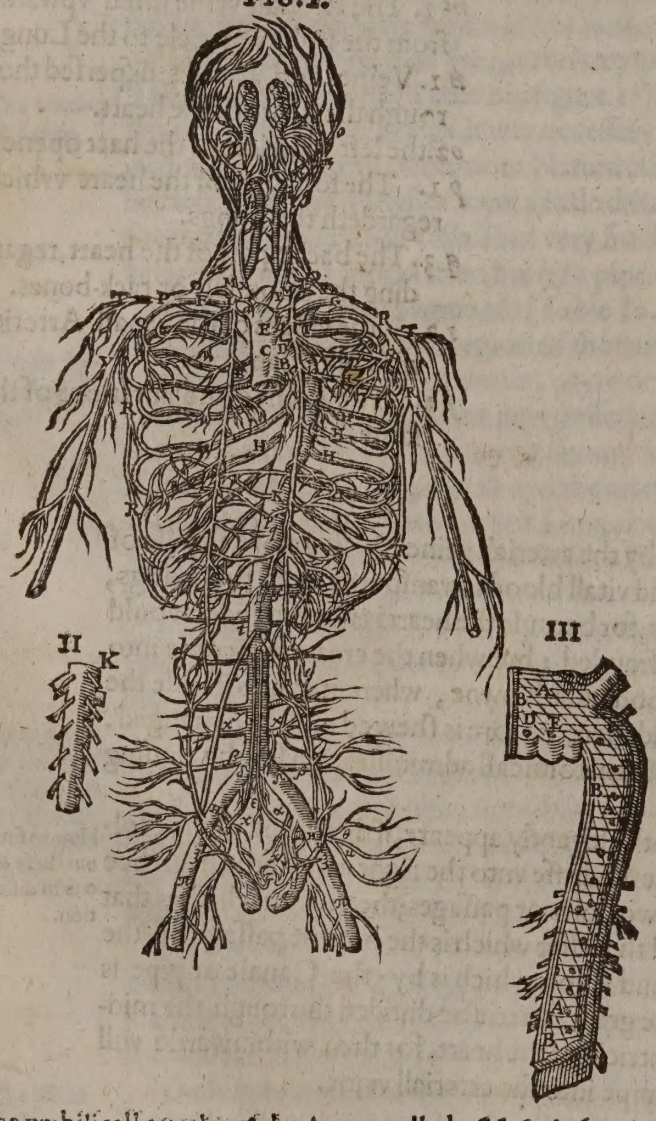
Table 13. Fig. 1, ſheweth the trunke of the great Artery, together with his branches as they are diſſeminated through the three bellies or Regions of the body.

The ſecond Figure ſheweth a portion of the Arterie as it is on the backeſide, from whence it ſendeth branches to the diſtances betwixt the Lower ribbes.

The thirde Figure, ſheweth a portion of the great Artery, where it yſſueth out of the Heart is heere ſhewed open: & by that meanes wee may better perceyue his Coates and Fibres.

TABVLA. XIII.

FIG. I.



A. The orifice of the great Arterie, where it is continued with the heart.
BB The Coronary arteries.
C the diuiſion thereof.
D the deſcending trunke.
E the aſcending trunke.
F the right Subclauian artery, whoſe originall at *a* is higher then the lefte.
G The left *ſubclauian* Artery, whoſe originall is at *b*.
H,I. The vpper *Intercoſtall* Artery at I. reaching to eight diſtances of the ribbes at H.
K the *Phrenicke* Arteries on either ſide.
* The trunke of the great Artery, where it paſſeth through the Fiſſure of the Midriffe.
L L the *Mammary* artery.
ccc Growing to the Muſcles that are betwixte the griſtles, and to the paps.
M M. The artery called *Ceruicalis*.
NN the ingate thereof into the bone of the *Occipitium*.
O O the artery called *Muſcula*.
P P. the right and the left Axillarie Arteries.
Q Q. the vpper cheſt Artery, called *Thoracica ſuperior*.
R R. The lower called *Thoracica inferior*.
S S the artery called *Scapularis*.
T T. the Artery called *Humeraria*.
V V. the remainder of the Axillarie artery reaching to the armes. Arteries.
X Y the right and left *Carotis* or the ſleepie
ee The coniunction of the Mammary with the Epigaſtricke Arteries.
ff the diuiſion of the ſleepy arteries at the *chops*
g the externall branch.
h the internall branch which is deriued to the throtle, the Chops, and the tongue.
i This at the *baſis* of the ſcull is diſtributed into two branches.
l the diſtribution of the braunch *g*, vnto the Cheeks, and the Muſcles of the face.
m the diſtribution of the braunch *g*, vnder the roote of the eare.
n the ſame branch creeping vp the temples.
o And the backeſide of the eare.
p the ſtomacke artery called *Cœliaca*.
q the vpper Meſentericall artery.
r ſ the emulgent arteries,
tt, *vv* the ſpermaticall arteries
x the lower Meſentericall artery.
yyyy the arteries of the Loines called *Lumbares*

α the vmbilicall arteries. *β* the Artery called *Muſcula ſuperior*. *δδ* the byfurcation of the great artery into the Iliack branches. *ε* the artery called *Sacra*. *ζζ* the inner bow of the left trunke. *ηη* the vtter bowe which deſcendeth to the thigh. *θ* the artery called *Muſcula inferior*. *λλ* the artery called *Hypogaſtrica*. *μ* the remainder of the ſame bow, which being encreaſed by a branch from the exteriour paſſeth by the ſhare-bone. *ννν* the arterie called *Epigaſtrica* to which the Mammarie arteries marked with *ee* are ioyned. *ξξ* the artery called *Pudenda*. *ππ* the Crurall artery. *Figure* 2 & 3. AAA, A coate like a Spiders web. B B the inner coate of the artery. C, the vtter coate of the artery. D E the original of the Coronary arteries. 1,2,3 Three Values ſet to the orifice of the Artery in the heart.

heart: afterward it yſſueth out of the *Pericardium* and is vnequally diuided into two parts, one aſcending vpward to the head [Tab.13,fig.1 [E]] which alſo is the leſſe, the other and larger by farre tendeth downward [Tab.13,fig.1 [D]] becauſe the parts below the Heart, are many more then thoſe aboue.

Out of the greater deſcending trunke [Tab.13.fig.1 [D]] which in the Cheſt is large and thicke, theſe branches following do yſſue. The deſcending trunke,

The lower *Intercoſtall* Arteries [Tab.13,fig.1 [HHH]] which are ſent vnto the diſtances of the eight low ribs. *Intercoſtales.*

The Artery called *Phrenica*, that is, of the Midriffe, on each ſide one [Table.13 fig 1, [KK]] which are diſſeminated through the Midriffe and the *Pericardium*. *Phrenica.*

The remainder of the trunke pierceth through the Fiſſure or perforation of the midriffe [Tab.13.fig.1,*] and cleauing to the bodies of the Spondels or rack-bones, doth diuerſelie communicate it ſelfe through the lower belly.

The leſſer and aſcending [Tab.13.fig.1 [F]] trunke being faſtned to the Weazon is communicated to all the parts of the body aboue the heart; and firſt of all it is forked into two notable branches, which vnder the Pattell or coller-bones bendeth to the firſt ribbe of his owne ſide, and therefore it is called *Arteria ſubclauia*, for the Latines call the coller *Bones Clauiculæ*, [Tab.13,fig.1, [FG]] then the trunke is diuided into the two arteries called *Carotides* or the ſleepy Arteries. The aſcending trunke. *Subclauia*

The right *Subclauia* [Tab.13,fig.1 [F] his originall is at [a]] iſſueth out of the great artery, euen where it is parted into the ſleepie arteries, it is higher, larger and runneth more ouerthwart then the left, whoſe courſe to the arme is rather oblique then tranſuerſe. The right.

From theſe *Subclauiæ* before they fall out of the Cheſt (for after they are out of the cheſt they are no more called *Subclauiæ* but *Axillares*) [Tab.13.fig.1 [PP]] as ſoon as they touch the firſt rib do paſſe certaine propagations.

From their Lower part, that which is called *Intercoſtalis ſuperior*. [Tab.13.fig.1 II] *Intercoſtal. ſup. Mammaria.*

From their Vpper part yſſue, firſt the *Mammaria* [Tab.13.fig.1 [LL]] which vnder the breſtbone being reflected together with a Veine, deſcendeth vnto the Paps and the Muſcles, [Tab.13.fig.1 [CCC]] betwixt the griſtles of the true ribbes, and ſo deſcendeth vnder the right Muſcles of the Lower belly vnto the Nauell, where it is diuided into many ſurcles [Table 13, figure 1 [dd]] and ſo meeteth with the Epigaſtricall Arterie aſcending vpward. [Table 13 fig.1, [ee]]

Secondly the *Ceruicalis*, [Tab.13,fig.1, [MM]] which yſſueth more backeward toward the bodies of the rack-bones, and at the 7. ſpondell of the necke entreth in at the holes of the tranſuerſe proceſſes of thoſe ſpondels, and ſo is communicated to the Muſcles, the marrow of the necke, and the Spondels themſelues. Betwixt the firſt ſpondell and the nowl-bone theſe Arteries on either ſide [Tab.13,fig.1 [NN]] enter into the ſcull, and at the Baſis of the braine they are vnited. *Ceruicalis.2.*

Thirdly, the *Muſcula* [Tab.13,fig.1 [OO]] becauſe it watereth the Muſcles of the necke. *Muſcula 3*

From the Axillary artery, [Table. 13, fig. 1 [PP]] ſo called becauſe it paſſeth by the Axilla or Arme-hole before it reach vnto the arme, do yſſue from the lower part *Thoracica ſuperior* [Tab.13,fig.1 [QQ]] which deriueth his branches to the Muſcles lying vpon the breaſt. *Thoracica inferior* [Tab.13, fig 1 [RR]] which creepeth downe the whole ſide of the cheſt. *Scapularis* [Tab.1,fig.13,S] diſſeminated to the Muſcles in the hollowe part of the Shoulderblade. From the vpper part *Humeraria* [Tab.13,fig.1, [TT]] which climbeth to the toppe of the ſhoulder, and is diſtributed into the Muſcles thereabout. That which remayneth of the Axillary artery [Tab.13,fig.1, [QQ]] being accompanied with the Axillary veine paſſeth vnto the arme. From the Axillary Artery. *Thoracica ſuper* *Thoracica infer* *Scapularis.* *Humeraria.*

That which remaineth of the aſcendent trunke [Tab.13, fig.1, [F]] lying vpon the ſharpe Artery and ſupported by the Sweete bread, whilſt it is yet in the cauity of the cheſt is diuided into two vnequall branches which they cal *Carotides*, [Table 13,fig.1 [XY]] or the ſleepie Arteries, which riſing directly vpward are by the mediation of a Membrane tied to the wezon and the internall iugular veines, and ſo attaine vnto the head. But of theſe wee ſhall ſpeake more in the eight Booke. *Carotides.*

CHAP.

CHAP. XVII. *Of the Lungs.*

THE Lungs which are the inſtruments both of the voice and alſo of reſpiration, the Grecians cal *Pneumones*, becauſe of the reception of the ayre which they call *pneuma*, or from a word which ſignifieth to breath, for by breathing inward they drawe ayre, and by breathing outward doe put it foorth againe.

Why placed in the cheſt.

Theſe Lungs are allowed by Nature to all breathing creatures, and placed in the cauity of the Cheſt [tab. 3. NOP] becauſe they were to be a little diſtant from the mouth leaſt by the affluence of the ayre they ſhould haue beene preſently cooled. In liuing creatures whileſt they breath inward they fill the whole cauity of the Cheſt, excepting the region which wee haue already ſayed the membranes of the *Mediaſtinum* [Table 3. L] and the heart couered with his purſe doe occupy: but when the creature breatheth out then they fall, but not ſo as they doe in dead bodies flat and flaccid, becauſe they are ſtill full of ayre and bloud: and although they may bee puffed vp in a dead body by putting a payre of bellowes into the weazon, yet hardly can you rayſe them to ſuch a height as that they will occupy ſo much place as they doe in a liuing body. For being to contayne ſo much ayre as ſhould ſuffice the diuerſe motions of the heart, that we might not be conſtrayned to be alwayes fetching breath to ſpeake, ſing, or cry out, it behoued well that their quantity ſhould be very great.

How to puffe them vp in dead bodies.

Why ſo great.

Their connexion.

And although for the moſt part they hang looſe and at liberty that they might more freely mooue, yet by the mediation of the veſſelles of the weazon they are ſuſpended and hung to the neck and the back leaſt they ſhould fall downward, and by the interpoſition of the *Mediaſtinum* [tab. 3. GH to A] they are tyed forward to the breaſt-bone, backward to the rack-bones; alſo in ſome places at the ſides of the cheſt they grow to the *pleura* with fibrous tyes produced from their owne membrane, which is peculiarly obſerued in men as in the wiſeſt creature: by which meanes the Lungs which of themſelues are deuoyd of all motion more eaſily follow the motion of the Cheſt do otherwiſe then for the auoyding of *vacuum* or emptineſſe.

How they follow the motion of the cheſt.

Galen verily thought that the Lungs followed the motion of the cheſt for the auoiding of that *vacuum* or emptineſſe which is ſo irreconcileable an enimy of Nature, becauſe the cheſt being diſtended they are dilated as they are filled with ayre drawne in; and the ſame cheſt being contracted and the Lungs euacuated by expiration, they fall into themſelues: which he ſheweth by an inſtance of a wound of the cheſt. For if the Cheſt be wounded ſo that the ayre can get into it, the Lungs ſayth he become immouable and do not follow the dilatation of the cheſt, becauſe there is ayre which filleth the vacuity or emptineſſe of the cheſt; but when the cheſt is ſound and diſtended, the Lungs are neceſſarily dilated leaſt there ſhould bee *vacuum* or emptines, and the ſame Lungs, not for the auoyding of emptines, but either being compreſſed by the cheſt, or becauſe of the ayre breathed out or both together, they fall neceſſarily.

Galens opinion for the auoyding of *vacuum* or emptines.

His demonſtration.

But we adde, that Nature taking knowledge of the neceſsity of the motion of the lungs, that the cheſt being perforated the ayre going in by the wound might not hinder the dilatation of the Lungs which is cauſed for the auoyding of emptineſſe, hath knit them in men onely as we ſaid before to the *pleura*, that ſo by the neceſsity of this connexion they ſhould follow the dilatation of the cheſt though it were perforated. They alſo adhere to the heart by the arteriall veine [tab. 9. fig. 2. C] and the venall artery.

How the lungs moue when the cheſt is wounded.

They haue their figure (which is ſhewed in the 3. and 4. Tables) according to the proportion of the parts vpon which they reſt: wherefore on the outſide that they might be fitted to the cauity of the cheſt, they are gibbous and ſwelling; on their inſide hollow [table 9. figure 1. and 2. table 14. figure 1.] to giue way to the heart couered with his purſe, which with their lobes or diuiſions they encompaſſe round about. When both parts the right and the leſte are ioyned, they repreſent the ſhape of a clouen foote of an Oxe or ſuch like, [Table 14. figure 1. and 2.] for as the hoofes before are diuided aſunder by a line as it were; ſo the Lungs backward [Tab. 13. fig. 2.] (becauſe of the bodies of the *vertebræ* or ſpondels) haue an oblique impreſsion or diuiſion, and forward they cleaue in the very middeſt. They are diuided by the *Mediaſtinum* [table 3. GG HH] into a right Lung and a leſte, that one part being hurt the other might ſerue the vſe of the Creature (for oftentimes as wee ſee in the cutting vp of ſuch as dye of Conſumptions of the Lungs, the one Lung on the one ſide beeing vlcerated yea and conſumed, yet the man may liue long with the vſe of the other)

Their figure.

Like a clouen hoofe.

How they are deuided.

and

They are onely ioyned together by the mediation of veſſels [Table. 14, fig. 1] which are diſſeminated into them from the Weazon & the heart. Againe, each Lung is diuided into two Lobes or Finnes if you draw a line from the place of the fourth rackbone or *vertebra* of the Cheſt: obliquely ouerthwart [Tab. 14, fig. 2] to wit, the vpper Lobe or Fin & the lower, yet ſo, that in a man they adhere together by Membranous Fibres, ſo that there is rather a note or footſtep of diuiſion then any true diuiſion indeede, (though it bee otherwiſe in Dogges) and the lower is longer then the vpper. And it is ſo diuided, as well that the whole Lungs might more ſafely and ſwiftly be dilated and contracted (the aer breathed in more eaſily penetrating into their narroweſt paſſages) as alſo that they might the more firmely embrace the heart, and not be compreſſed when we bow downward. And althogh they be found to be diſtinguiſhed (though not with any true diuiſion) ſomtimes into three, ſometimes into more, ſometimes into two, yet rarely ſhall we find in a man, becauſe of the ſhortnes of his breſt, fiue Lobes; in a dogge and an Ape often: and if it happen to be ſo, then ſaith *Galen* in the 2. and 10. Chapters of his 7. Booke *de vſu part*, they ly very high into the throat vnder the hollow-vein. Their ſubſtance [Tab. 14, fig 2.] is fleſhy (wherupon it is called *Parenchyma* & a fleſhy bowell); wouen with three ſorts of veſſels [Tab. 14, fig. 2 ABD] and couered with a thin Membrane, which varieth in ſoftnes and colour, according to the age of the party. In yonger men it is faſter, in the prime of our age more rare and hollow. For the Lunges being not mooued in the wombe of the Mother as neither the heart, are then thicke and firme as is the ſubſtance of the Liuer; red alſo from the colour of their nouriſhment, for nouriſhed they are in the Mothers wombe with that wherewith they were generated, that is, blood brought out of the Hollow veine to the venall artery by inoculation; and ſpirits ſent from the great artery to the arteriall veine by the pipe or canale before mẽtioned: but the infant being borne when the heart beginneth to mooue, his motion and heate ſoftneth and puffeth vp their fleſh by little and little, and ſo being mooued with the motion of the Cheſt, they alſo become pliable to the motions thereof, and are lifted vp and fall againe with eaſe; they lye alſo bedded as it were betweene the diuiſions of the veſſels filling vp the empty places, and by that meanes are a defence and ſtrengthning vnto them that they be not broken in their continuall motions. And this is the reaſon that *Plato* calleth their motion ἅλμα μελικὸν, *ſaltus mollis* a ſoft motion, which is furthered in that their ſubſtance is full of a ſlimy and viſcid moyſture, inſomuch that *Varolius* ſaith that after death if they be cut, yet will they glue together againe by this viſcidity.

The Lobes or Finnes of the Lungs

Their ſubſtãce

How their ſubſtance and colour diſtereth before & after birth.

Plato his *Mollis ſaltus.*

Why they ioyne after death, being cut or ſliced.

Their ſubſtãce

Their ſubſtance alſo is laxe, ſpongy and rare, made as it were of the froth of the blood, that it may better admit the aer drawne in like a paire of Bellowes, and be freely filled therwith. Their colour is yellowiſh, oftentimes aſhie, ſpotted with certaine dull and blackiſh ſpeckes or cloudye ſtreames; and in thoſe that dye of any long and lingering diſeaſe they grow yet blacker.

Their colour.

They haue a Membrane bred out of the *Pleura*, for where the veſſels paſſe into the lungs [Tab. 14, fig. 1, CD] ther their common coate ſprung from the *Pleura* departeth from them, and is finely ſtretched ouer the ſuperficies or vpper face of the Lungs, to forme & containe their ſoft ſubſtance, which otherwiſe being ſhaken with continuall motions would quickly breake off by peece-meale.

Their Membrane.

This Membrane is thin, that it ſhould not be burthenſome, and ſoft that it might better ſtretch with the motion of the Lungs, full alſo of pores though after death inſenſible, that if any quitture or matter ſhould be gathered in the cheſt in a pleuriſy or inflamation of the Lungs called *Peripneumonia*, it might by theſe pores haue yſſue, & ſo be ſpit out by Cough; albeit we are not ignorant that in both theſe diſeaſes the Lungs themſelues are affected; which we are taught by the diſſection of Pleuritical bodies; and alſo by them which haue recouered of Pleuriſies, in whom doth remaine difficulty of breathing, and ſome payne in the weakned ſide as long as they liue.

Why the mẽbrane is porous.

This poroſite alſo makes their vpper face ſmooth, and bedewed with a kind of ſlimy moiſture. Into this Membrane, becauſe it needed but a little ſenſe, there are ſmal Nerues diſſeminated from the ſixt coniugation; on the right ſide [Tab. 8. fig. 1 r] after the right Recurrent is framed, but on the left ſide [Tab. 8, fig. 1 q] before the framing of the recurrent, theſe Nerues do not reach vnto the ſubſtance of the Lungs, leaſt they ſhould be pained or wearied in their continuall motion; and hence alſo it is, that all the vlcers of the Lunges are without paine.

Why Vlcers of the Lunges are with paine

They haue diſſeminated through them three veſſels [Tab. 14. fig. 1, BCD] whoſe diuerſe bran-

A A, 1, 2. The Gullet called *æsophagus* vnder the wezon or Rough arterie.
B 1, 2. The rough artery.
C 1, The arteriall veine.
D 1. The venall artery.
E F G H, 1, 2. The foure Lobes of the Lungs.
K, 1 The Midriffe.
I, 2. The Canale or pipe of the Lungs.
A 3. The Orifice of the arteriall veine.
abc, 3. His three Values.
B 3. The inner Coate.
C 3. The vtter coate
D 3. The diuiſion of the arteriall veine.
E F. 3. The two Trunkes whereinto it is diuided.
GGGG 3. The diſtributi-on of the ſame through the ſubſtaunce of the Lungs.
A, BB, CC 4. The orifice of the venall Arterie, marked with A. where it groweth to the heart, then diuided into foure trunkes.
EEEE 4. Their diſtribution through the Lunges
F 4. The ſimple or ſingle coate of this artery.

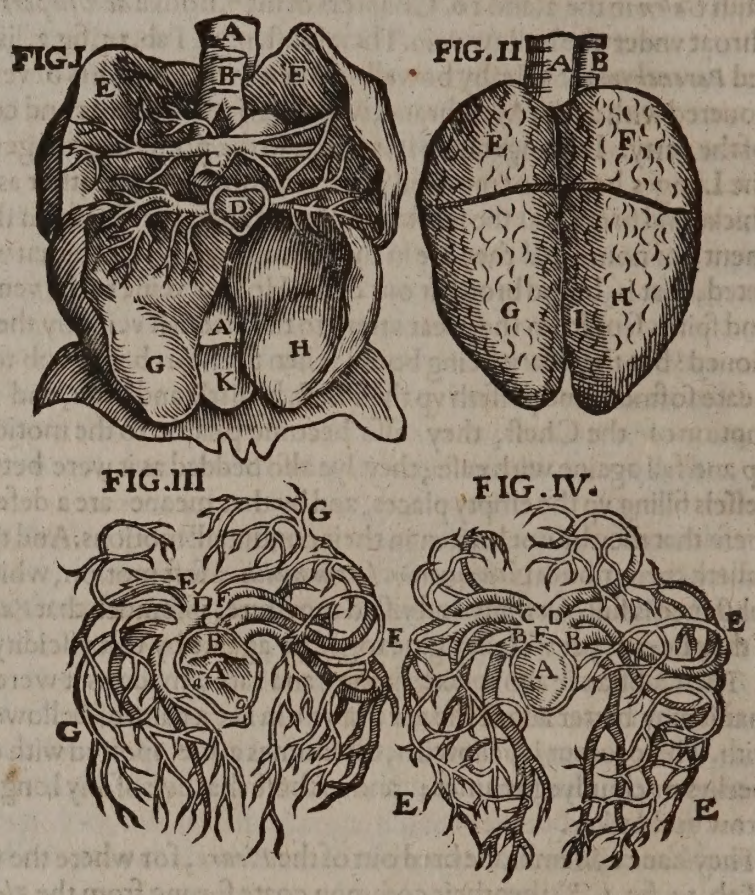
Table 14. Figure 1. ſheweth the fore-ſide of the Lungs taken out out of the Cheſt, from which the Heart with his Membranes are cut.

Fig. 2. ſheweth the backe and gibbous ſide of the Lunges, as it lyeth vpon the backe.

Figure 3. Sheweth the Arteriall Veine.

Figure 4. Sheweth the Venall Arterie ſeparated from the ſubſtance of the Lungs.

TABVLA XIIII.



branches ride ouer and mingle one with another. Theſe are diuided firſt into two, as the Lungs themſelues are, and preſently after into other parts, euery one keeping his courſe til at length they end in threddy branches at the very ſuperficies of the Lungs, between which veſſels their ſubſtance is circumfuſed as it is in the Liuer. One of theſe veſſels proper vnto the Lungs is called the rough Artery, or *Aſpera Arteria*, we commonly call it the wezon or winde-pipe. [Tab. 14, fig. 1 [B] and Tab. 15] The branches of this pipe are very great, and diſſeminated through the middeſt of the others, and bringeth aer drawne by the mouth and the noſe to the Lungs, of which we wil ſpeake in the next chapter.

The winde-pipe or weazon called *Aſpera Arteria.*

Two veſſels it receyueth from the heart, of which wee haue ſpoken before, one called the arteriall veine [tab. 14. fig. 1, [C] Fig. 13. the whole arteriall veine] which out of the right ventricle miniſtreth to the Lungs Alimentarie blood therein attenuated for their nouriſhment, and with this blood the naturall ſpirit and the naturall ſoule therein reſiding with all her powers and faculties are communicated to the Lungs.

The Arteriall veine.

The other called the venall artery [tab. 14, fig. 1 [D] figure. 4 the venall arterie ſeparated] which is an inſtrument onely of the ſpirits, but conteyneth alſo pure, thinne and vaporous blood; wherefore the aer which was attracted by the winde-pipe, and prepared in the lungs it leadeth to the heart, and from the leſte ventricle bringeth foorth vitall bloode with the

vitall

vitall ſpirit and faculty to the Lungs, partly that therewith they may bee nouriſhed, partly for their life that the in-bred heate may be cheriſhed, (for life is from the vitall ſpirite and the arteriall bloud perfected in the left ventricle of the hearte) partly that by it the ſmoake and ſoot may be carried out of the heart. Whence life is.

Theſe two veſſels are farre greater then the magnitude of the Lungs may ſeeme to require if the proportion be compared to that of other parts, & that becauſe the Lungs with their perpetuall motion do conſume and diſsipate much moyſture; and moreouer becauſe they ſerue not onely to carry out naturall bloud and vitall bloud with vitall ſpirits; but alſo by their extremities doe receiue from the ends of the winde-pipe ayre which they lead into the ventricles of the heart; and if any ſmall braunch of theſe veſſelles be broken the Lungs become purulent and yeeld matter vp in coughing, as *Hippocrates* ſayeth in his firſt Booke *de morbis*, and in the ſame place addeth, that the Lungs with their heat do draw vnto them ſelues phlegme out of the whole body, eſpecially out of the head. Why theſe veſſels are ſo large.

And as the ſubſtance of the Lungs is differing from the ſubſtance of the whole body, ſo is their manner of nouriſhing; for there is no part either ſo rare, light and ſpirituous, or which is nouriſhed with ſo pure, thinne and vaporous bloud; wherefore the Lungs haue veſſelles contrary to thoſe which are in other parts: for in other parts the veins haue a rare and thin coat, that the thick bloud might be freely and ſpeedily diſtributed to the parts about them; for bodies are nouriſhed with bloud drawne through the verie coate of the veſſels, but the arteries are thicke and denſe or thight that the neighbour parts may for their life draw only ſubtile and ſpirituous bloud and but a little of it; becauſe no particle of the body though neuer ſo ſmall can bee preſerued without it: but in the Lungs all is farre otherwiſe. The coates of the veines [Tab. 14. figure 3. [BC]] are thicke and thight, that nothing but that which is very thinne may ſweate out, becauſe euery thing is nouriſhed with Aliment of his owne Nature, and the bodie of the Lungs being light and rare doe therefore ſtand in neede of a pure vaporous and thin bloud. Their difference from other parts in ſubſtance & maner of nouriſhment. How extraordinary in the Lungs.

But becauſe the Lungs as well in reſpect of their perpetual motion, as for their ſtore of heate which they haue partly by the vicinity or neighbour-hood of the heart, partly by the aſsiduity of their motion; doe neede more plentifull nouriſhment then other parts: therefore Nature hath giuen to their arteries the coate of a veine [Table 14. figure 4. [F]] that they might yeelde vnto the Lungs thinne and ſpirituous bloud plentifully and in aboundance: that becauſe the veines in regard of their thickneſſe or denſity yeelded them leſſe ſtore of nouriſhment, aboundant recompence might be made by the arteries which becauſe of their thinnes and rarity cannot containe it from them.

Theſe three veſſels ſome will haue to be moued according to the motion of the Lungs; others according to the heart; onely the weazon or aſper arterie is dilated when the lungs are dilated. But the venall artery is moued truely after the motion of the heart, but not with the ſame motion nor with the ſame power or vertue that the arteries or pulſes are moued with. For the heart in his dilatation drawes ayre from the venall artery; in his contraction he thruſteth foorth a part of the vitall bloud together with the ſooty excrements: wherefore this venall artery is emptied in the dialtation of the heart and filled in his contraction. How theſe 3. veſſels are moued, & by what vertue.

The vſes of the Lungs is, firſt to be the inſtruments of reſpiration and of the voyce, (for all thoſe creatures that want Lungs vſe not to breath and are mute beſide) for beeing dilated, like a paire of bellowes they receiue in ayre from the braunches of the windepipe, which they prepare as being the ſhoppe of the ſpirites, and by degrees change it for the vſe of the heart, which otherwiſe ſhould receiue it impure and ruſhing ſuddenly and at once in to him; and by this delay and preparation it becommeth a conuenient nouriſhment for the in-bred ſpirite. For ſome quality of the aire is familiar and agreeing with that inbred ſpirit, another is full of enmity and wil corrupt it; and hence it is that we ſee thoſe that dwel in houſes newly limed get diſeaſes, and eſpecially the fume or ſmoother of coales and ſuch like will preſently kill a man. The vſes of the Lungs. New limed houſes are dangerous to dwel in.

This ayre the heart in his dilatation draweth vnto it ſelfe by the branches of the venall artery out of the rootes of the winde-pipe whoſe mouthes doe meet, whereby hee is cooled; for euery thing that is hot is nouriſhed, cheriſhed and conſerued by that which is moderately cold, as *Hippocrates* ſaith in his Booke *de natura pueri*: For as a flame being ſtraitned in a narrow place and not ventilated with the ayre is conſumed; ſo our Naturall heate when it wants cooling growes weaker (as they know well which ſit in hot houſes) and faint

and is at length extinguished; for as a flame it is continually moued; wherefore the Philosophers called the Lungs the Fan or flabell of the heart; and *Plato* thought that the heart when it was heated with anger was tempered againe by the Lungs.

Gal de vsu respir. expoundeth this saying of *Hippoc.*

Againe, when they are constringed and contracted in expiration (for in inspiration and expiration life doth consist saith the Philosopher in the 21. chapter of his Booke *De respiratione*) they driue out the aer that remaineth by the same way, that it may giue place vnto that which is fresh, and make also matter for the voice: this aer when it comes in is colde, when it goeth out hot, because it hath met with the heate that is conteyned in the Heart. Another vse of them is in expiration to auoide the fuliginous and smoaky sootinesse of the heart and spirits, and the thin and thicke excrements of the Lungs gathered in the braunches of the sharpe Artery or Weazon by coughing into the winde-pipe, which are carried vp as in a Reede and spit out of the mouth, yea sometimes cast out with a cough.

CHAP. XVIII. *Of the Weazon or winde-pipe called the sharpe Artery, or Aspera Arteria.*

Of the winde-pipe.

THE third proper vessell of the Lungs the Ancients called simply the Artery, because it containeth aer; the later Writers with *Galen* call it the sharpe artery, because of the inequality of his substaunce, and to distinguish it from the smooth Arteries; we call it commonly the weazon or winde-pipe.

His position.

It is one and a great pipe [Tab. 15, fig. 1 and 2] giuen to all creatures which haue Lungs, it looketh toward the holes of the nose which open into the mouth, and is placed before the Gullet or *œsophagus* [Tab. 14, fig. 1 ^{AA}] vpon which it lyeth in the bottome of the throate, and is carried directly downward from the mouth along the necke (which seemeth to be framed especially for this cause) into the Lungs, into which it alwayes gapeth very wide, and in his lower part is diuided into many smaller Pipes, called by *Hippocrates* in his Booke *de locis in homine*, *Syringas* and *Aortas*, which determine in the Lungs with manifold branches. [Tab. 15, fig. 1, ^{bb}, ^{cc}]

The throttle or Larynx.

The vpper part of it which is the head, is called *Larynx*, we call it the throttle: [Tab. 15 fig. 1 and 2 $^{g\ h}$] of it we will speake in our History of the mouth: the rest [Tab. 15, fig. 1 ^{aa}] is called *Branchus*, because it is moystened with drinke.

His connexiō

The head of it or the Throttle is tyed to the throate by his inwarde coate, then by his outward coate it groweth forward, and at the sides to the Muscles and Vessels that neighbour about it, but behinde to the *œsophagus* or Gullet by certaine Fibrous tyes that it may descend downward the safer.

His substance

His outwarde coate.

The substance of this part is partly Membranous, [Tab. 15, fig. 2 ^{f}] partly gristly, [Tab. 15, fig. 2 ^{dd}] and is inuested with two coates, one outward arising from the *Pleura* which is thinne and groweth exceeding fast to the Membranous bandes of the Cartilages or Gristles, and is as it were a couering to the pipe, which by this coates interposition is tyed to the parts neere hand, and ioyneth the Recurrent sinnewes neerer to this arterie, and beside leadeth them more safely along.

The inwarde coate.

The other coate is inwarde, arising from the coate that inuesteth the Palate of the mouth: this encompasseth the whole pipe, whereby the gristles are more firmelie ioyned together; it is thight and solide and much thicker then the outward, by which his thickenesse and solidity the artery is warranted from the iniuries which might come by any sharp Rheume or other matter that should fall from the head or bee hawked vp, as sometimes salt Flegme and putrid, sometimes bilious or cholericke, sometimet ill qualited and sharpe quitture which is coughed out of the Lungs, or by any sharpe things that should fall or bee swallowed downe, as fumes or vapors and meats or drinkes of a tart or sharpe quality; yet is this coate in the branches dispersed into the Lungs farre thinner then in the throtle, least it should hinder the attraction of the aer, or the expulsion of the smoake or soote, but in the middle of the pipe it is of a middle consistence.

The sound of the voyce in burning Agues.

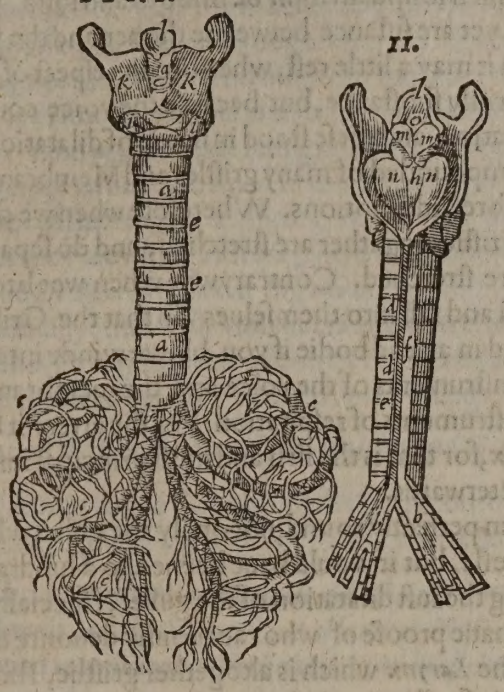
This coate wouen with right Fibres which runne through his length, is soft & smooth and smeared ouer with a fatty and vnctious humor that the artery might not bee dryed eyther when hot aer is drawne in, or when sharpe fumes yssue out in great outcries or clamorous motions, for that such drineſſe would be very offensiue to the voice and the transmission of aer: for when the parts which appertaine to the throate and to this vveazon are vehemently dryed, as it happeneth in burning agues, then follow those sounds of the voice which *Hippocrates* in many places, calleth κλαγγώδεις *Clangosas*, which beginne base and end

sharp

Tab.15. Fig.1. sheweth the foreside of the throttle and the weazon, and the branches of the same dissеminated through the substance of the Lungs. Fig.2. sheweth the backeside of the Throttle, and of the trunke of the weazon.

TABVLA. XV.

FIG. I.



II.

aa 1. The pipe of the Rough Arterie or weazon.
bb 2. The diuision of the same.
ccc 1. The distribution of those branches through the Lungs.
dd 2. The semi-circular gristles of the weazon.
ee 1,2. The Membranous Ligaments.
f 2. The Membranous part of the weazon-pipe.
g 1. The forepart of the Throttle or Larynx.
h 2. The back-part of the same.
ii 1. the two Glandules.
kk 1. The Gristle called *Sentalis*.
l,1,2. The *Epiglottis*.
mm 2. The gristle called *Arythenoides*.
nn 2. The gristle called *Crycoides*.
o 2. the slit which we call the *Glottis*.

sharpe, as if the voice failed in the end as it doth in drunken men; and this kinde of voyce is of euil presage in such Agues; but when the parts are abundantly moistned as in destillations & poases, then the sound is raucous or hoarse, but beside such destillations it is moistened by a humor conteined in certaine Glandules [Tab.15, fig:1. 11] set at the root of the throttle or Larynx, and others that lye vpon them (for it is rare to finde small Glandules in the pipe it selfe though sometimes it be so) as also by a part of the drinke which insensiblie descendeth by the sides of the pipe [Tab.15, fig.1 aa] as we shall say when we come vnto the History of the Larynx. The Glandules of the Throttle.

This coate is also verie sensible, that it might quickly finde fault with that that troubles it and solicit the Lungs to cough it vp. Betweene these two coates are placed the gristles, and their proper Membranous Ligaments. [Ta.15, fig2 ee] For this winde-pipe is made of many gristles like rings, but not fully round [Tab.15, fig:2 dd] wanting a fourth part on the backe-side, which are called *Sigmoides*, resembling the old Greeke *Sigma*, and our Ↄ thus turned backward, the Physitians in *Galens* time called them *Bronchia*: These all along are equally distant one from another, and the vpper are greater then the lower, and thicker in their bredth, especially in the middest, because their middest standeth formost, that the artery might not easily be hurt by outward iniuries. The Gristles of the Weazō. Their Forme

These by little and little are attenuated and grow thinner, and so go as it were into a mēbrane, and are knit to the proper membrane of euery gristle [tab:15, fig:1 e e] by the interposition as it were of a *Periostion* Ligament-wise: but this ligament if it may be so called, is in brute beasts more Membranous, and in men more fleshy: or shal we cal these ligaments [tab:15, fig:2 ee] small muscles, because they intersect themselues like the intercostall Muscles, and fill vp the distances of the gristles. Conexion & Scituation.

And because the gristles do not make a perfect circle or rundle on the backpart, they are so ioyned by the help of membranous productions brought from the ends of the gristles, that the gristles with these membranes [tab.15, fig: 2 f] doe make a perfect and full though not a round circle. And this their substance and structure was more meet for their vse then any other. For if either the weazon had beene made of one gristle, or of many altogether round, it would haue bin alwayes alike open, which would haue bred a difficulty in inspiration and expiration, because it is necessary that it should arise and fal with the lungs. It could not haue bin made onely of a membrane, for then the membrane being soft would fal, and so the cauity not alwaies be kept open; beside that, or any other such soft substance had bin vnmeete for the generation of the voice, as wee may perceiue in instruments when the strings are moist. How they are ioined behind. Why this their structure is best.

How sound is made.

But because this pipe was to be the instrument not onely of respiration, but also of the voyce, it behooued that this substance should be gristly and rigid, or stiffe and harde like a pipe, not onely for the freer egresse and regresse of the aer, but also for the necessity of the voice, because the sound could not be made without the collision or beating of the aer as it goeth out against a hard body. For that which soundeth must be smooth and solid, that there may bee a symetrie or proportion, and yet are sistance betweene the aer and the substance against which the aer smiteth at which it may a little rest, wherfore in respect of the sound it might haue consisted onely of one gristly substance, but because the voice coulde not be formed without inspiration and expiration and these stood in neede of dilatation & constriction, it was necessary it should be compounded of many gristles and Membranous Ligaments, by which it might performe the foresaide motions. Wherefore when we draw in our breath, the ligaments which tye the Gristles together are stretched, and do separate the gristles so much assunder as themselues are stretched. Contrarywise when wee breath out, those ligaments are loosed and doubled and fall into themselues so that the Gristles touch one another, which may bee perceiued in a dead bodie if you blowe winde into his weazon: and therefore the Gristles and the instruments of the voice and the membranous ligaments which ioyne them together, are instruments of respiration. For the artery it selfe prepareth the voice for the throttle or *Larynx*, for that is the first and most principal instru-

The Gristles serue the voice and the Ligamentes the breathing instrument of the voice, as we shall declare afterwards.

Add to this, that if the gristly rings had been perfectly round, not onely the gullet which is soft would haue beene hurt by their hardnesse, but it would haue beene also a hindrance to the swallowing of the meate, by restraining the iust dilatation of the gullet, especially in the swallowing of solid meates, which they haue proofe of who rauenously deuoure their meate before it be chewed: wherefore, that the *Larynx* which is altogether gristlie, should be no impediment to the Gullet, the Gullet in swallowing is drawne downeward, and the throttle ascendeth vpward.

The inconuenicncy of the rings if they had bin round

The diuision of the winde-pipe.

When this pipe commeth [Tab.15, fig. 1, ^{aa}] into the capacity or hollownes of the chest to his fourth rack-bone, it is diuided into two trunkes [Tab.15, fig.1 and 2 ^{bb}] the right going to the right side, the left to the left side of the lungs, into which when they are passed, they are againe subdiuided on eyther side into two other branches to each Lobe, and these into many others, [Tab.15, fig.1, ^{cccc}] whose gristles are sometimes triangular, sometimes square, sometimes otherwise formed, and passe on disseminated euen to the extreamities of the Lungs, that they might better fit themselues to their dilatation and constriction, neither be obstructed but bee free for inspiration and expiration, and alwayes open for the auoyding of any matter Rheumaticke, Bloody or Purulent by Cough or otherwise. The branches of these diuisions are placed betweene the branches of the venall arterie and the arteriall veine [Tab.14, fig.1 ^{BCD}] in the middest, and are greater then either of the other, but so that the Veine is on the backside of it, and the artery on the right, which presently as it comes out of the heart entreth the Lungs, for that it was not safe that his thinne coat should runne along without some Firmament, hauing so actiue and flippant matter in it. Necessary it was that these branches of the Weazon should be neere vnto both those vessels and ioyne mouths with them; and first with the Venall artery, that so there might bee free passage out of the Rough Artery into the smooth for the aer to passe to the left ventricle of the heart, and as free an outlet for the vapors and soote, but not for bloode & other humors, vnlesse it be by violent Coughing; wherefore, if at any time they become more open then they should be, eyther by breaking one of them, or by opening of their orifices, or if any of them should be gnawne asunder, then part of the bloode contained in the branches of the smooth Arteries is powred into these Rough, which hindreth the recourse of the breath taking vp the passages of it, and so suddenly followeth a cough, and the bloode comes vp into the mouth; but if that which insensibly slid downe the Weazon, & so passed vnto his lowest pipes do thicken in the outlets which are very smal, it breeds such a difficulty of breathing, as that his breath seemeth continually to faile, and he in great necessity of perpetuall inspiration.

Why the brā ches of the windpipe ioin mouths with the venal Artery.

The causes of coughing of blood.

The cause of shortnesse of breath.

Why they ioyn with the arterial veine

Secondly, it was necessary it should ioyne with the arteriall veine, and that by inoculation, that from the veine it might receiue blood for his nourishment. And this is the manner of the coniunction of the Weazon to the Heart by the mediation of the smooth arteries, and how small propagations of the Veines are inserted into the strings of the windepipe for their nourishment, because of themselues they are altogether without blood, but

the

the ſmooth or venall arteries haue no Veynes inſerted into them, becauſe they them-ſelues containe blood. Moreouer, the Rough arteries hath ſmall veſſels deriued vnto them from the neighbour veſſels.

This Vſes of this Weazon are, that the Lungs as a paire of bellowes might by it, as by a Conduite or pipe draw aer in reſpiration atracted by the noſe and mouth (for the lungs being dilated, onely the rough artery is dilated) and ſend it to the heart, and by the ſame paſſage conſtringed, ſend out from the heart the hot aer which is vnprofitable for it, together with ſmoaky vapors and ſooty excrements, and deliuer them out of the mouth and noſe. And againe, that it might be the inſtrument of the voice; for to the generation of the voyce which is formed in the Throttle, the aer which is breathed in, and is the proper matter of the voice is required, euen as wee may obſerue that in the pipes of the bellowes when they are filled with aer, there is a ſound engendred. Wherefore *Hippocrates* in his Booke *De Morbs* called it *Organum vocale & ſpirabile*, a breathing and vocall inſtrument. And finally, that with violent exſufflation either in coughing, of deepe hauking (for that which is lightly hawked vp comes but from the roots of the tongue) thoſe things which fel from the head, or are gathered in the Lungs might by it bee caſt forth.

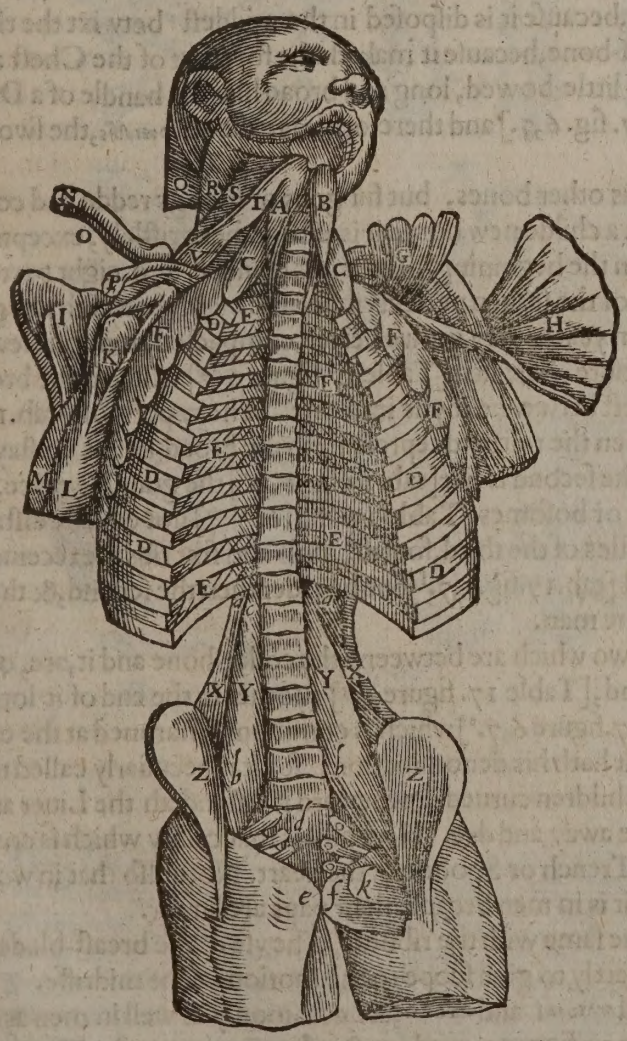
The vſes of the Weazon. First. Second. Third.

CHAP. XIX. *Of the Muſcles and Nerues which are in the cauity of the Cheſt.*

HAuing runne through all the parts conteyned in the Cheſt, and as it were remooued them out of the way, we meete with certaine Muſcles, Nerues and Bones.

Table 16. ſheweth the Cauitie of both Bellies without the bowels and the Midriffe, as alſo what Muſcles & what bones remaine when the bowelles and breſt-bone are remooued.

TABVLA XVI.



A B. The firſt Muſcle mooving the Necke, or the long Muſcle.
C C. The ſecond Muſcle mooving the neck called *Scalenus*.
DDDDD. the outward intercoſtal muſcles
EEEEE. The inward intercoſtall Muſcles.
FF. The Muſcle called *Serratus* maior, or the ſecond Muſcle of the Cheſt.
G. The Muſcle called *Serratus minor*, or the firſt Muſcle of the ſhoulder-blade freed from his Originall.
H. The Muſcle called *Pectoralis* or the firſt muſcle of the arme ſeparated frō his original
I the Muſcle *Deltoides* or the 2. of the arme.
K The ſhoulder-bone without fleſh.
L the firſt muſcle of the *Cubite*, cald *Biceps*.
M the 2. Muſcle of the *Cubite* cald *Brachiaus*.
N the Clauicle or coller bone bent outward
O the firſt muſcle of the Cheſt cald *ſubclauius*
P The higher proceſſe of the Shoulderblade
Q The ſixt muſcle of the head or the Lower Oblique.
R. The ſecond Muſcle of the head.
S. The fourth Muſcle of the Shoulder-blade or the *Leuator*.
T V. The two bellies of the fourth Muſcle of the bone *Hyois*.
XX *aa*. The fift Muſcle of the backe, whoſe beginning is at *aa*.
YY *bb*, *cc*. The firſt Muſcle of the thigh, called *Pſoa*, whoſe Original is at *cc*. and his Tendon at *bb*.
ZZ. The 7. Muſcle of the Thigh.
d The holy-bone or *os ſacrū*, out of the holes whereof at *o* certaine Nerues do yſſue.
e A part of the fift Muſcle of the thigh at the ſhare-bone. *f* The ſhare-bone bared.
k The ninth Muſcle of the Thigh, or the firſt Muſcle whereby it is turned.

The

Two muſcles. The Muſcles are two, called *Ceruicis longi* [tab. 16.[AB]] the long muſcles of the neck, which being ſcituated vnder the gullet are affixed to the rack-bones. The muſcles which are ſeated on the ſides and behind and doe extend the head and the necke, wee haue in ſome ſort deſcribed before in the third Chapter of this Booke.

Two kinds of nerues. There are alſo two kinde of Nerues which paſſe thorough the cheſt; one from the ſixt paire of the marrow in the brayne, exhibited in the firſt figure of the 8. table: another from the ſpinall marrow which is either in the racke-bones of the necke or of the cheſt; of which alſo we haue ſpoken before in the 10. Chapter.

CHAP. XX. *Of the Clauicles, Breaſt-bone and the Ribs.*

The figure of the coller-bones. THE Clauicles or Coller-bones are called in Greek κλεῖδες becauſe they ſhut vp the whole Cheſt; they are two, on each ſide one, ſcituated ouerthwart in the bottome of the necke and top of the breaſt. Their figure is not ſtraight but outwardly embowed at the *iugulum* [tab. 17. fig. 2.[H]] and on the inſide hollow; contrariwiſe at the ſhoulder they are hollow on the outſide and imbowed within, [tab. 17. fig. 1, 2, 3.] but in men they are not ſo crooked as in Apes, and doe neare reſemble the letter *ſ*. Likewiſe in women they are leſſe crooked then they are in men [table 17. fig. 4.[K]] which maketh them leſſe nimble in the mooving of their armes, as wee may ſee when they offer to caſt a ſtone: notwithſtanding they haue a manifeſt protuberation or ſwelling, & alſo two lines [tab. 17. fig. 1, 3.[F] fig. 2, 3.[FG]] that from thence the *ſubclauian* muſcle and a part alſo of the *Pectoral* might ariſe. They are alſo on either ſide exaſperated [table 17. fig. 1.[K] fig. 3.[F]] toward their ends, from which exaſperation or inequality doe proceed certaine ligamens; as alſo the ſeuenth muſcle of the head called *Maſtoides*.

Why not ſo crooked in women.

Their inequality or roughnes.

Why called *Iugula*. Theſe *Clauicles* on either ſide faſten the ſhoulder-blade to the braſt-bone by *Diarthroſis*, a notable griſtle being betweene them. [Table 17. figure 5.[TS]] *Celſus* called them *Iugula a iungendo*, of ioyning or becauſe they are like to the yoake wherein Oxen are ioyned which we call *Iugum*.

Their vſe. Their vſe is to hinder the ſhoulder-blade and armes from falling vpon the breaſt.

The breaſt-bone. The breaſt-bone is called στέρνον, becauſe it is diſpoſed in the middeſt betwixt the ribs, [Table 17. figure 9 [ghi]] or the breaſt-bone, becauſe it maketh the forepart of the Cheſt and ſecureth the parts vnder it. It is a little bowed, long and broad like the handle of a Dagger as the antients vſed it [Table 17. fig. 6, 7.] and therefore it is called ξυφοειδὴς, the ſword-like cartilage or the *Breaſt-blade*.

The ſubſtance of it. The ſubſtance of it is not ſolide as other bones, but fungous or ſpongy redde and compounded of bones and griſtles.

The diuiſion of it. In a childe new borne it is altogether griſtlely, excepting the vppermoſt which is a bone from the beginning. Then it is deuided into eight partes; ſeauen of them receiue the griſtles of the ſeauen perfect ribbes; the eight receiueth the griſtle called *enſe-formis*. After ſeauen yeares they growe better compacted and haue fewer partitions and at length are onely foure. The firſt [Table 17. figure 6.[a]] which is the broadeſt; the ſecond and the laſt, the reſt betweene ioyne into one.

The quantity of the parts. The vppermoſt [tab. 17. figure 6.[abc]] is larger and thicker then the reſt, and repreſenteth the broad knubs or ſtay at the end of the Dagger handle. The ſecond is like [tab. 17. fig. 6.[pqr]] the graſping place, & in the ſides of it hath many cauities or boſomes [Table 17. fig. 6.[klmn]] not equally diſtant one from another, wherein the griſtles of the third, fourth, fifth and ſixt ribs are receiued. The third bone is leſſe then the firſt [tab. 17. fig. 6, 7.[f]] but broader then the ſecond, & theſe are all that appeare bony in a growne man.

The griſtles of this bone. The griſtles of it beſide thoſe two which are betweene the coller-bone and it, are, one betwixt the firſt bone and the ſecond, [Table 17. figure 6.[h]] another in the end of it long, immouable and triangular [Table 17. figure 6, 7.[e]] which is commonly ſharpned at the end like the poynt of a ſworde, whence it hath his denomination, for it is peculiarly called the *Breaſt-blade*. If this griſtle be in children curued downeward it offendeth the Liuer and the ſtomacke and ſuch children pine away and dye. Here alſo is that cauity which is commonly called *Scrobiculus cordis*, the Trench or Spoone of the heart. Note alſo that in woemen the breaſt bone is flatter then it is in men becauſe their paps are larger.

The vſe of this breaſt-bone. The vſe of this breaſt-bone is the ſame with the ribbes. The vſe of the breaſt-blade is partly to defend the parts vnder it, partly to giue ſcope to the motion of the midriffe.

The ribs. The ribs which the Greekes call πλευραί and σπάθαι, are commonly as well in men as in women, on either ſide twelue. [Table 17. figure 9. 10. character from one to 12.] They are many

Table 17. *hath twelue Figures, whereof foure shewe the Coller-bone. The first the anterior part: the second the posterior: the third the lower part: the fourth the Coller-bone of a woman which is straighter then of a man.*

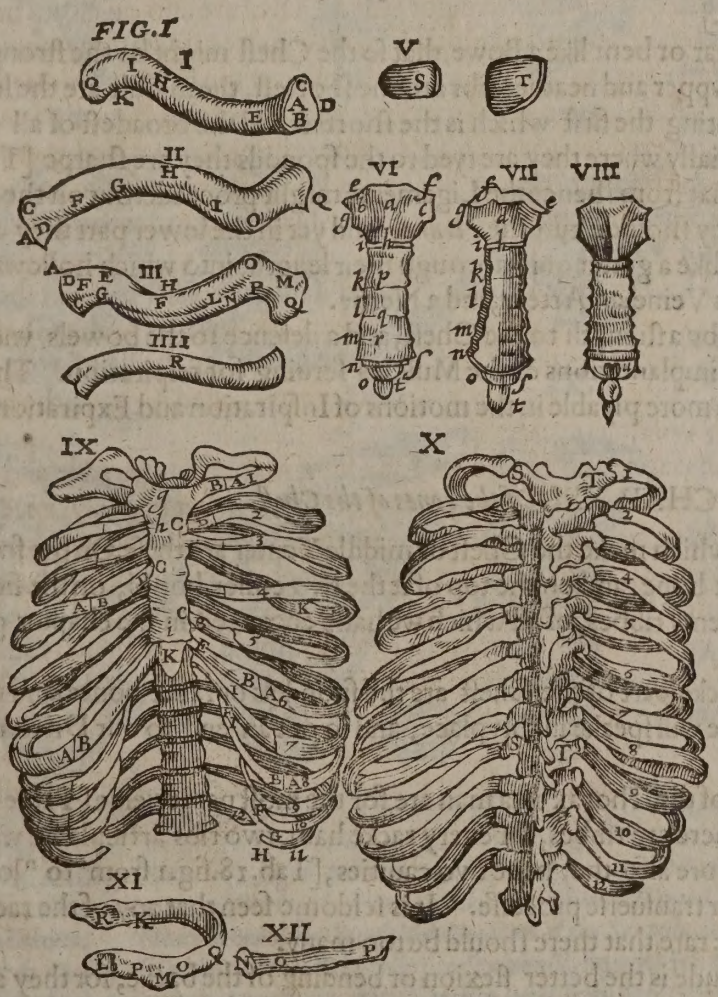
The fift Figure sheweth two gristles placed on either side betwixt the ioynts of the Coller-bone.

The sixt Figure sheweth the foreside of the breast-bone. The seauenth the back-part thereof. The eight sheweth the foreside of the breast-bone of a woman, together with the hole therein after the fashion of a Heart.

Figure 9. *sheweth the foreside of the bones of the Chest. The tenth the backeside. The eleuenth one of the true ribs broken. The twelfth sheweth the back part of the twelfth broken.*

From the first Character to the twelfth, in the 9. *and* 10. *Figures are exhibited the twelue ribs: the seauen vppermost true ribs: the fiue lowermost bastard ribs.*

TABVLA. XVII.



A 1 2 3. The head of the clauicle which is ioyned to the breast-bone.

B 1. The first angle or corner of this head.

C D 1 2 3. The second and third angles

E 1 3, The eminent and forward line of the clauicle.

F G 2 3. The lower line which neare G is rugged.

H 1 2 3, The middest of the clauicle or coller-bone which is round.

I 1 2, The *exterior* part which is broader and crooked.

K 1, A roughnes in that place.

L M N 3, The lower side of the clauicle which is situated and rough, and about N ther riseth a ligament which is fixed into the inner processe of the shoulder blade.

O 2 3, A swelling of the clauicle oppo site to the breast-bone.

P 3, the lower roughnesse of the inner side,

Q 1 2 3, The playne or smooth heade wherewith it is ioyned to the shoulder blade.

R 4, the coller-bone of a woman.

S 5, That cartilage or gristle of the coller-bone which is betwixt his ioynt with the shoulder blade.

T 5, the other gristle which is betwixt his ioynt with the breast bone.

a 6, The swelling or bunching prominence of the first bone of the *sternon* or breast-bone.

bc 6, An impression or doke on eyther hand at the sides of the sayed prominence.

d 7, The backeside of the breast-bone which is somewhat hollow.

ef 6, The bosome or cauity which admitteth the coller-bones.

g 6 7, The bosome or cauity to which the first rib is articulated.

h 6 7, the articulation or ioyning of the first bone with the second.

i 6 7, The *sinus* or hollownes to which the second rib is ioyned.

k l m n o 6 7, Other *sinus* or bosomes to which the fiue following ribs are articulated.

p q r 6, the lines which remayne after the bones do grow into one.

s 6 7, the third bone of the *sternon*.

t 6 7, the gristle of that third bone.

u 8, A hole made in the bottom of the brest bone carrying the representation of a heart. *Fig.* 9. 10. 11. & 12.

AB 9, The ioyning of the ribs with their gristles. CD 9, The articulation of the gristles of the ribs with the breast-bone. E 9, The blunt heade of the gristle. FF 9, the gristles of the bastard ribs which are sharpe. *g h i* 9, the breast-bone in the midst of the ribs. GH 9, the distance betwixt the 11. ribbe where the gristle sometime is parted from the other gristles, but at 12, alwayes. II 9, An vnequall prominence of the gristles. K 9, the sword-like cartilage. K 11, A bosome running along in the inner side of the rib. LM 11, the head wherewith the rib is articulated or ioyned to the spondel or rack-bone L. and M sheweth the head whereby it is ioined to the transuerse processe. N 12, the blunt head of the 11, and 12, ribs. O 11, 12, A knub into which the 11, muscle of the back is inserted. P 11, An *asperity* or roughnes betwixt the two heads which bringeth forth a ligament. Q 11. A roughnes with a light extuberation into which the muscle of the chest called *Sacro lumbus* is implanted. R 11, The fungous substance of the rib appearing when it is broken.

many that hauing many muskles, the cheſt might more eaſily be moued, yet ſeldome fewer or more then 12.

Their diuiſion

They are diuided into true or legitimate, & baſtard or ſpurious ribs: the legitimate are the ſeauen vppermoſt, [Tab.17.fig.9. from char.1 to 8] ſo called becauſe they perfect their ſemi-circle. They are ioyned backward with ſtrong Ligaments to the racke bones of the back [Tab.17,fig:10 ST] by *Diarthroſis*, & that with a double knot to make them the faſter.

Their Connexion. And Names.

The vpper knot is to the body of the Spondell, the lower to the latterall proceſſe. Forward they are articulated to the breſt-bone [Tab.17,fig.9 ^{c}] by certaine griſtles growing vppon their heads. The two vppermoſt of theſe are called *Retortæ*, the two next *Solidæ*, the three laſt *Pectorales*. The baſtard ribs are the fiue lower; ſofter as being almoſt griſtly, at leſt they end into a perfect griſtle. Theſe fiue are retorted or bent vpward, and ſo are glewed togither [Tab.17,fig.9 ^{FF}] excepting the laſt which is the twelfth.

Theſe are alſo imperfect, becauſe they are knit onely to the ſpondels but touch not the breſt bone, that ſo the Lower belly eſpecially the ſtomacke and the wombe might better bee dilated or enlarged. The eleuenth and the twelfth are ſometimes tyed vnto the Midriffe.

The ſubſtance of the Ribbes.

The ſubſtance of the ribs is not onely bony (though that bonyneſſe be but ſpongy) [tab. 17.fig.11, ^{R}] but euery one hath his proper Cartilage both behinde where they are tyed to the Spondels, and alſo before where they are ioyned to the breſt-bone [Table.17, fig.9, $^{A\ B}$ ſhewes the coniunction of the ribbes with their Cartilages, and $^{c\ D}$ the coniunction of the cartilages of the breſt-bone.]

Their Figure Magnitude.

Their figure is ſemi-circular or bent like a Bowe, that ſo the Cheſt might be the ſtronger and more capacious. The vpper and neather ribs are the ſhorteſt, the middle are the longeſt and the broadeſt excepting the firſt which is the ſhorteſt and the broadeſt of all the reſt. On the outſide eſpecially where they are tyed to the ſpondils they are ſharpe [Tab. 17,fig,11 ^{P}] and vnequall, that from thence the Ligaments might proceede: but on the inſide they are ſmooth leaſt they ſhoulde hurt the *Pleura*, and yet in the lower part they are hollowed [Tab.17,fig.11 ^{K}] like a gutter quite through their length, into which hollownes they receiue three Veſſels, a Veine, an Artery, and a Nerue.

Their cauity.

Their vſe.

The vſe of the ribbes is to be a ſtrength to the Cheſt, and a defence to the bowels vnder them, they receyue alſo the implantations of the Muſcles ſeruing for reſpiration. Their Griſtles alſo doe make them more plyable in the motions of Inſpiration and Expiration euen when we are aſleepe.

CHAP. XXI. *Of the bones of the Cheſt.*

THE bones which make the Cheſt or middle Venter are theſe. On the forepart the breſt-bone, and on the top of it the two coller-bones, on the ſides foure and twenty ribbes, of all which we haue entreated in the chapter going before.

The ſpondels.

On the backe-part of the Cheſt are the ſpondels or racke-bones, and the ſhoulder-blades, of which we will ſpeake in this place, and ſo put an end to our Diſcourſe of the Middle Venter.

Their number

The Spondels therefore of the Thorax in a man are for the moſt part twelue [Table 20 Fig.1. at ^{D}] iuſt ſo many as there are ribbes, for euery racke hath two ribs articulated with it, [Tab.18.fig.5. $^{D\ F}$] wherefore alſo they haue two cauities, [Tab.18.fig.1 from ^{c} to ^{D}] one at their ſides, another at their tranſuerſe proceſſe. It is ſeldome ſeen that any of the racks are wanting, but much more rare that there ſhould be too many.

The reaſon of their number.

The reaſon of their multitude is the better flexion or bending of the backe, for they are put together with ioynts knit and tyed with ſtrong Ligaments [Table.18.fig.6. character 5. Tab.20.fig.1, ^{RR}] betwixt euerie one of which there runneth a Cartilage to make the motion more nimble and glad. [Tab.18 fig.6. char.1,& 3]

Their Forme or Figure.

Theſe Spondels haue bodies bunching out in the middeſt round, embowed aboue [tab 18.fig.1] and below [Tab.18.fig.1,2,3,4 ^{A}] plaine, thicker alſo then the rackes of the neck and leſſe ſolid, thrilled alſo with ſmall holes made for the paſſage of thoſe veſſelles that deriue nouriſhment vnto them and the marrow of the backe.

Their proceſſes.

Their proceſſes are ſome ſharpe, cald *Spinales* [Tab.18.fig.1,& 2 ^{MNP}] which bend downward: others tranſuerſe [Tab.18.fig.1,2,3,4 $^{B\ I}$] which are thicker, ſolid and long ending in a round head for the firme articulation of the ribs: againe, others aſcending which are two

[Tab

Tab. xviij. ſheweth the backeward bones of the Cheſt.
Figure 1 *exhibiteth the fore-face of the middle Spondell vnto which the other ten are very like.*
Figure 2. *The backe-part of the ſame Spondel.*
Figure 3. *The backe-part of the eleuenth Spondel.*
Figure 4. *the backe part of the twelfth ſpondel.*
Figure 5. *The three middle Spondelles of the Cheſt, together with their articulation with the rib.*
Figure 6. *ſheweth the griſtly Connexion of two ſpondels.*
Figure 7. *ſheweth the inward part of the right ſhoulder-blade.*
Figure 8. *the outward, as the* 9. *Figure ſheweth the ſide.*

TABVLA. XVIII.

A 1,2,3,4. The vpper-part of the Spondel, to which the lower part is anſwereable.
Φ 3. The vpper *Appendix* of the head of the *Vertebra*, to which the lower *Appendixe* is like.
BC 1. The boſome which receyueth the rib marked with B. another leſſe boſom at C.
D 3 5. The boſome of the eleauenth racke-bone to which the eleauenth rib is articulated, and in the fift Figure it is ſhewed together with the rib.
E 4. A *Sinus* or hollowneſſe in the twelfth Spondell.
F 4. A roughnes or inequality in the bone bringing foorth the Ligament or tye of this ioynt.
G 2,3,4. The holes that are in the backſide of the bodies of the rack-bones.
HI, 1,2,3,4 The tranſuerſe proceſſes of the rack-bones of the Cheſt.
KK, 1,5. A *Sinus* in the top of the tranſuerſe proceſſes, to which the rib is articulated.
L 1,2. the gibbous or embowed part of the tranſuerſe proceſſe,
M 1. the hollow part of the tranſuerſe proceſſe.
NOP, 1,2. The ſpine diſtinguiſhed in the three ſides by three lines.
Q 1. A ſharpneſſe in the inſide of the ſpine.
R 3. The ſpine of the eleuenth racke-bone.
S 4. the ſpine of the twelfth racke bone.
TV 1 the foreface of the aſcending proceſſes.
XY 2,3 the backface of theſe proceſſes.
ab, 2,3. the outward face of the deſcending proceſſes.
c 1. Their foreface cruſted ouer.
ef 4 The aſcending proceſſes of the twelfth rack bone which goe vnder the eleuēth.
gh 4. The deſcending proceſſes of the xii. racke bone, which are articulated to the Cauities of the aſcending proceſſes of the firſt racke bone of the loines.
i,l,l, 5. The three middle *Vertebræ* ioyned together.
mn 5. the boſome which is in the body of the *Vertebræ*, and receiueth the heade of the rib.
o 5 the articulation of the rib to the tranſuerſe proceſſe. *p* 5 the circular bowing of the ribbes from D to *p*. backward, from thence to *f* forward. *qr* 5. the ioyning of the rib with his Cartilage. *ſ* 5. the blunt heade of the Cartilage. *Char.* 1,2, fig. 6 A Cartilage ioyning the *Appendices* of eyther rackbone to their Bodies. *Char.* 3,4 Fig, 6 the appendices of eyther rackbone. *Char.* 5. Figure. 6 A griſtly Ligament ioyning both the rack bones. *Heere followeth a threefold delineation of the Scapula or Shoulder-blade.* AB, 7,8. The boſome or cauity of the blade which is called *Acetabulū*, into which the bone of the ſhoulder entreth. *a* 8, A griſtle which enlargeth that cauity, which is alſo by it ſelfe deſcribed and noted in K. CD 7,8. the neck of the ſhoulder-blade. E 7,8, the leſſer proceſſe of the ſhoulder-blade. F 7,8. the knub of the ſame, vnto which the Clauicle is connected. *f* 7, the roughneſſe thereof which bringeth foorth a Ligament. GH, 8,9 The Spine of the ſhoulder-blade. I, 8,9. the thicker part of the ſpine which hath an Appendix. K, 7,8,9 *Acromion* conſiſting of an Appendixe. L 7. the *ſinus* of that *Acromion* ſuſtaining the Coller-bone. MMMM. Certaine ſmall dens made by the contaction of the ribs. NOP 7, the inward hollow part of the roote of the ſpine at NO. the inward extuberation of the lower ſide at P. *p* 7, the ſharpeneſſe of the ſhoulder-blade in the vpper ſide. Q 7. the *ſinus* of the lower ſide from whence ariſeth the firſt Muſcle extending the Cubite. S 8 the outward protuberation or ſwelling of the Lower ſide. T 8, An impreſsion of the lower ſide from which ariſeth the fourth Muſcle of the arme called *Rotundus maior*. V,V 8 the cauitie of the outſide of the *Scapula*. X 7,8,9 An Appendix of the *Baſis* of the ſhoulder blade. Y 7,8,9, Another Appendixe of the lower angle. Z 7,8,9 The vpper angle of the baſis of the ſhoulder blade. Φ 7, the inner protuberation or ſwelling of this angle. *a* 7,9 the boſome of the vpper ſide of the ſhoulder blade. *b* 9, The thinneſt part of the ſhoulder blade. *c* 9, Heere ſometime is found a ſmall hole through which the veins do creep for the nouriſhment of the bone.

[Table 18.figure 1.[TY]] and two deſcending [tab. 18.figure 2,and 3.[AB]] notwithſtanding the tranſuerſe proceſſe of the 11. and 12. ſpondels [tab.18.fig.4.[EFHG]]doe differ from the proceſſes of the reſt.

Appendices 5. The haue alſo fiue *Appendices*, two at their bodies aboue and [tab.18.fig.3.[Φ]]beneath; two at the tranſuerſe proceſſes,and one at the end of euery ſpine.

Their perforations. The holes or perforations of theſe rack-bones are bored according to the thickneſſe of the marrow that muſt iſſue out of them;[table 18.figure 2,3,4.[G]] for as the marrow in diſcending is attenuated,ſo are the holes of the lower ſpondels ſtraightned.

CHAP. XXII. *Of the ſhoulder-blades and racks of the neck.*

The ſhoulder blade. THe ſhoulder-blade called *Os ſcapulæ* is on each ſide one [Table 18.figure 7,8, 9.] which hangeth vpon the ribs on the backeſide like a buckler,and is articulated with the ſhoulder or arme and the coller-bone,ioyned alſo to the ribs, the bone *Hyois* and the *occipitium* or nowle-bone by the mediation of the muſcles.

His connexion.

His figure. The Figure is almoſt triangular, on the inſide it is concauous or hollow [Table 18,fig.7 [M]] on the outſide [Table 18. figure 8.[YY]] it buncheth, and that bunch is called the Baſis of the bone ;it hath alſo an angle or corner,and a ribbe both aboue and below,from which is produced a ſpine tending vpward.[table 1.8.fig.9.[GH]]The vpper angle is ſhewed in the 18. table fig.7,8,9.

The proceſſes. The proceſſes of this *ſcapula* aboue are three; the firſt is very ſhort and determineth with a ſhort necke [table 18. fig.7,8.[CD]] into a hollowed head [table 18. figure 7,8.[AB]] ſuch as the Anatomiſts cal *Acetabulum* wherin it receiueth the head of the ſhoulder-bone. And this hollowed head of the *ſcapula* is compaſſed with a thicke griſtle[table 18.figure 8. [Z] and [X]] whereby the cauity is enlarged,leaſt that the head of the ſhoulder ſhould eaſily fal thereout.

Acetabulum.

The ſecond proceſſe is the very end of the ſpine and hangeth ouer the ioynt of the ſhoulder ; and therefore it is called *Humeri mucro* or *ſummus humerus*, The top of the ſhoulder, [Table 18. figure 7,8,9.[X]] and by this proceſſe the ſhoulder-blade is ioyned to the coller-bone.

The third is inward and leſſe [table 18.fig, 7,8.[F]] called *Sigmoides*, and this contayneth the ſhoulder-bone in his ſeate.

The *appendices*. The appendices,or if you will,appurtenances of the ſhoulder-blade are fiue, three are in the inſide and at the Baſis [table 18.figure 7,8,9.[XY]]affording a beginning to ſome muſcles; and two other out of which iſſue the ligaments which ioyne the ſhoulder to that hollow head of the blade wee ſpake of and alſo the coller-bone to the ſecond proceſſe which we called the top of the ſhoulder.

It hath alſo a double cauity one aboue, the other beneath the ſpine with the Anatomiſts *Interſcapulium*.

The ſubſtance The bone of the blade is very vnequall, for in the middeſt it is the thinneſt, the proceſſes thicke, medullous and ſpongy ; it hath alſo certaine perforations by which veines and arteries are admitted for his nouriſhment.

The Neck which was framed to ſuſtaine the head and to mooue the ſame, conſiſteth of

The ſpondels of the neck many ſpondels called *vertebræ* or rack-bones which are commonly ſeauen[tab.19.fig. 2,3. 4.] differing one from another and from the reſt of the *vertebræ* of the ſpine.

The firſt rack bone. The firſt [Table 19. figure 2,3.[FF] table 20. figure 2,3,4,] is called *Atlas*, and hath a thinner yet thighter and faſter body then the reſt,and wanteth the vpper proceſſe or the ſpine.

The proceſſes of it. The aſcending and deſending proceſſes of this rack are hollowed on either ſide, [table 20. figure 2, 3.[EF]] aboue to receiue the two proceſſes of the *occipitium* [table 19. figure 1.[DC]] for the better motion of the head, below to receiue the proceſſes of the ſecond *vertebræ*: [table 20.figure 5. 6.[MN]] it hath alſo at the ſides thereof two tranſuerſe proceſſes [table 19. fig. 2,3.[II] table 20.fig.2,3,4.[GO]]perforated [table 19. figure 2.[K] table 20.figure 2.[K] ſheweth the perforation] for the aſcent of a veine and an artery into the brayne.

The cauity of it. It hath alſo a cauity or *ſinus* [table 20.figure 2,3.[B]] cruſted ouer with a griſtle [table 20. figure 2,3.[C]] wherein it receiueth the tooth [table 20.figure 7. O] of the following *vertebra*,and at the proceſſes where the racks are ioyned there is alſo a *ſinus* on either hand : in the firſt [table 20. figure 4.[Z]] and the ſecond [table 20.figure 6.[Y]] it is like a chinck or rift: in the reſt it is orbicular as alſo it is long in the racks of the cheſt. Through theſe cauities

The vſe of the cauities.

the

Table 19. sheweth the bones of the necke.

Figure 1. the bone of the occipitium or nowle separated from the skull.

Figure 2. sheweth the coniunction of the seuen vertebræ of the necke as it appeareth in the back-part.

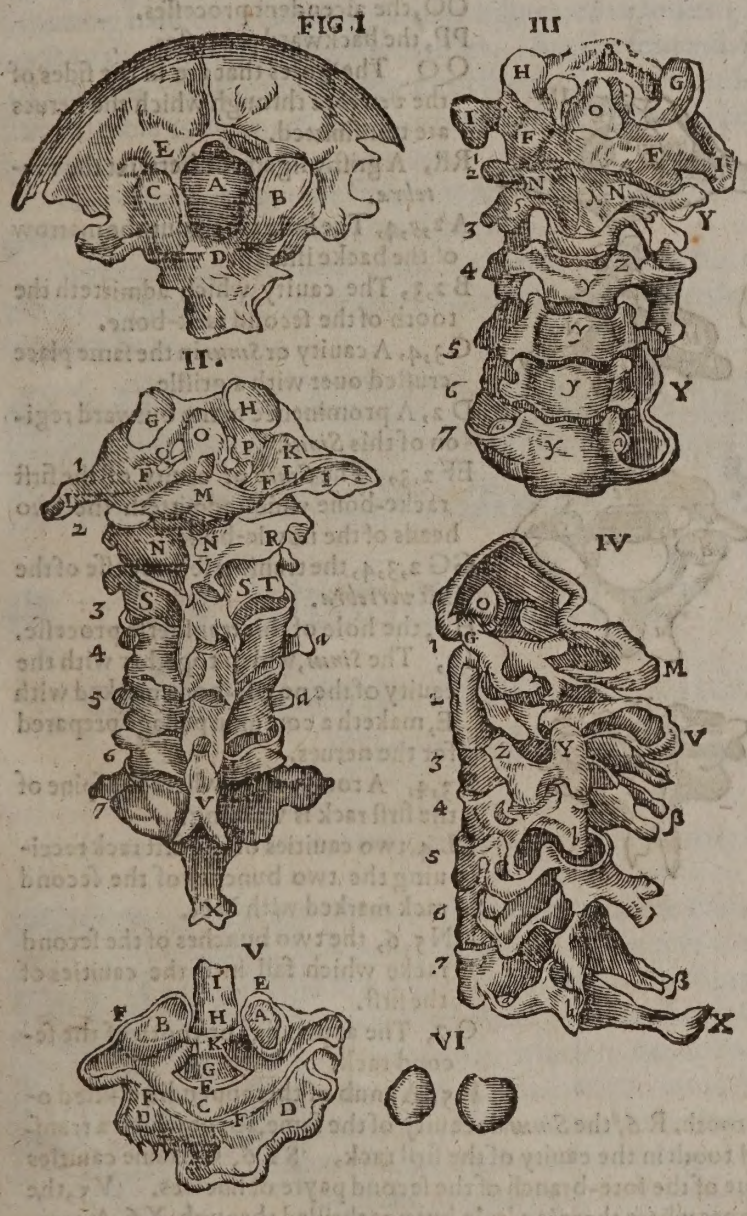
Figure 3. sheweth the forepart.

Figure 4. the lateral all face.

Figure 5. sheweth the ligaments which ioyne the first and the second rack-bones.

Figure 6. sheweth the gristles which are sometimes found betwixt these vertebræ.

TABVLA. XIX.



A 1, The hole in the nowle-bone made for the outlet of the spinal marrow.

BC 1, Two heades of the bone *occiput* or nowl-bone, which are articulated to the first rack-bone of the neck.

D 1, The roughnes wherein the ligament is inserted.

E 1, A *Sinus* or hollownes in the backepart of those heads, making a way for the first payre of sinewes.

FF 2,3, The first rackbone of the neck.

GH 2,3,4, the cauity of the first rack-bone receiuing the two heades of the nowle-bone.

II 2,3, The transuerse processe of the first *vertebra*.

K 2, the hole of this transuerse processe.

L 2, A cauity which with the cauity of the nowle-bone marked with E maketh a common passage which is prepared for the nerues.

M 2,4, A rough place there where the first rackbone of the neck wanteth the spine.

NN λ 2,3, the second *vertebra* of the necke whose body bunching in the middest & depressed on either side, λ in the third figure exhibiteth.

O 2,3,4, the appendix or processe of the second *vertebra* called the *Tooth*.

P 2, A hole made of the cauity of that Tooth & of the first rack-bone, through which smal branches of nerues are transmitted.

Q 2, A roughnesse wherein the hole is not perceiued to be thrilled through.

R 2, The descending processes of the second *vertebra*.

S 2,3, the third *vertebra* of the neck.

T 2, The descending processe of the third *vertebra*.

VV 2,4, The processes of the racke-bones on the backeside diuided thorough the middest.

X 2,4, The backeward processe of the seauenth rack-bone which is not clouen as the former ββ.

Y 3,4, The highest processe of the racke-bones.

Z 3,4, the two first extraordinary processes in the highest part of the *vertebra*.

aa 2, The extraordinary part of the lateral all processes.

ββ 4, The processes deuided through the middest.

γγγγ 3, the bodies of the racke-bones.

aa 3, 4, the holes of the lateral processes.

bb 4, The lower nodes or knots of the processe. Character 1,2,3,4,5,6,7. Shew the seuen *vertebræ* or racks of the neck.

Figure V.

ABCD, The first *vertebra* of the necke. ABC, the second DD. EF, A membranous ligament knitting the first *vertebra* to the nowle bone at E. and the first to the second at F. G, the body of the second *vertebra*. H, The tooth of the second *vertebra*. I, the ligament tying the tooth to the nowle-bone. K, A ligament compassing the tooth of the first racke-bone.

Figure VI. The gristles which *Vesalius* saith are sometimes found betwixt the two first *vertebræ*.

the coniugation of the nerues and the braunches of the veines and arteries do passe, which minister nourishment vnto the marrow and to the bones.

The second *vertebra* [table 19. fig. 2,3.^N table 20. figure 5,6,7.] besides his body, his

Table 20. Figure 1. ſheweth all the racke-bones of the backe knit together.

Figure 2. ſheweth the fore and vpper face of the firſt rack-bone of the necke.

Figure 3. ſheweth the backward and vpper face of the ſame.

Figure 4. the lower and backward face thereof.

Figure 5. the forepart of the ſecond rack-bones.

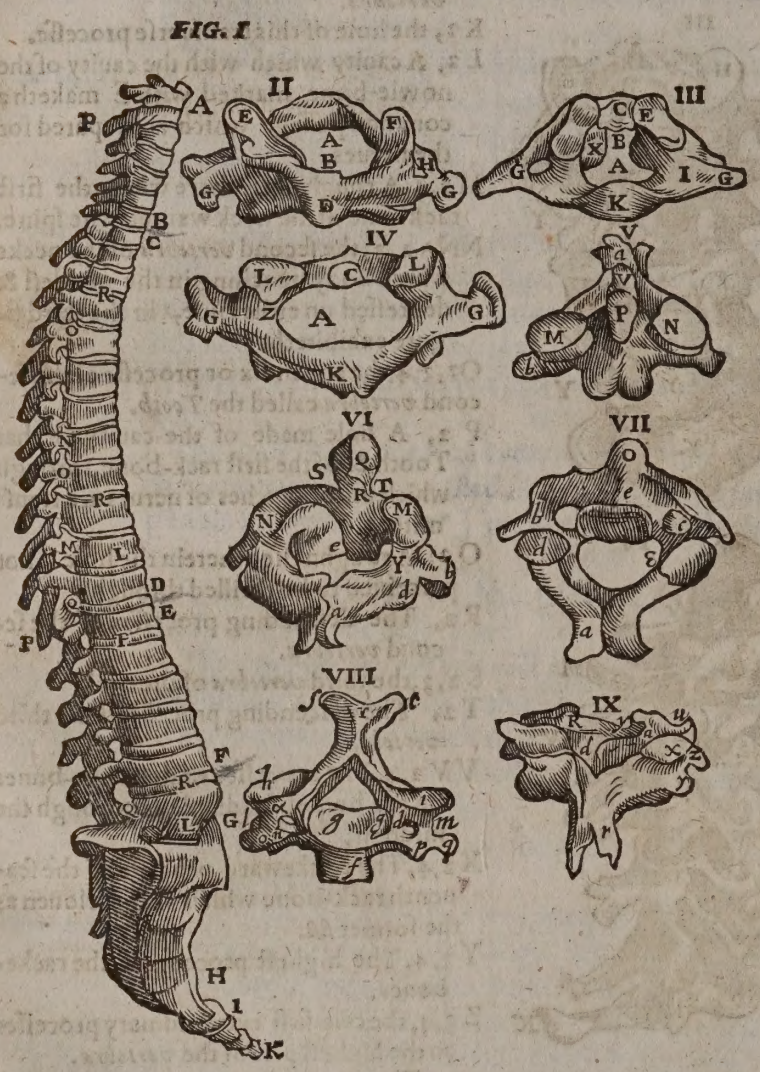
Figure 6. the back-part of the ſame.

Figure 7. the lower part of the ſayd ſecond rack-bone.

Figure 8. the foreward and vpper face of the third vertebræ.

Figure 9. the backer and vpper face thereof.

TABVLA. XX.



From A to B, The ſeuen *vertebres* of the necke.

From C to D, The twelue *vertebres* of the cheſt.

From E to F, The fiue rack-bones of the Loynes.

From G to H, The *Os ſacrum* or Holy-bone.

From I to K, The bone *Coccyx* or the rump-bone according to the late writers.

LL, the bodies of the *vertebræ*.

M, the tranſuerſe proceſſes of the *vertebræ*.

N, the deſcendent proceſſes.

OO, the aſcendent proceſſes.

PP, the backward proceſſes.

QQ The holes that are in the ſides of the *vertebræ* through which the nerues are tranſmitted.

RR, A griſtly ligament betwixt the *vertebræ*.

A 2,3,4, The hole whereout the marrow of the backe iſſueth.

B 2,3, The cauity which admitteth the tooth of the ſecond rack-bone.

C 3,4, A cauity or *Sinus* in the ſame place cruſted ouer with a griſtle.

D 2, A prominence in the outward region of this *Sinus*.

EF 2,3, The *Sinus* or cauity of the firſt racke-bone which admitteth the two heads of the nowle-bone.

GG 2,3,4, the tranſuerſe proceſſe of the firſt *vertebra*.

H 1, the hole of this tranſuerſe proceſſe.

I 3, The *Sinus*, which together with the cauity of the nowle-bone marked with E, maketh a common paſſage prepared for the nerues.

K 3,4, A rough place where the ſpine of the firſt rack is wanting.

LL 4. two cauities of the firſt rack receiuing the two bunches of the ſecond rack marked with MN.

MN 5,6, the two bunches of the ſecond racke which fall into the cauities of the firſt.

O 7, The appendix or tooth of the ſecond rack.

P 5, A knub of this appendix cruſted ouer with a griſtle. Q 6, the backſide of the tooth. R 6, the *Sinus* or cauity of the ſame, about which a tranſuerſe ligament is rowled contayning the ſayd tooth in the cauity of the firſt rack. ST 6, Certaine cauities at the ſides of the tooth whence the roots iſſue of the fore-branch of the ſecond payre of ſinewes. V 5, the poynt of the tooth. X 3, An *aſperity* or roughnes where there is a hole but not thrilled through. Y 6, A cauity of the ſecond rack which togither with the cauity marked with *Z* maketh a hole, through which the nerues do iſſue. Z 4, the *Sinus* of the firſt rack. *a* 5,6,7, the double ſpine of the ſecond rack. *b* 5, 6,7, the tranſuerſe proceſse of the ſecond rack. *c* 7, the hole of the ſaid tranſuerſe proceſse. *d* 6,7, the deſcending proceſse of the ſecond rack whoſe cauity is marked with *d* in the ſixt figure. *e* 6,7. the place where the body of the ſecond rack deſcendeth downward. *fgg* 8, The lower ſide of the body of the third rack at *f*, the two eminent parts of the ſame at *g g*. *h i* 8, the aſcending proceſſes. *l m* 8, The two deſcending proceſſes. *n o p q* 8, The tranſuerſe proceſſes. *r* 8,9, the ſpine or the backward proceſſe. *ſt* 8, the two toppes of the ſpine. *u* 9, the deſcending proceſſe of the third rack. *x* 9, the aſcending proceſſe. *y*, the tranſuerſe proceſſe of the third rack. *α* 8:9, the hole of this tranſuerſe proceſse. *β* 9, the vpper hollowed part of the body of the third rack. *δ* 9, the *Sinus* or cauity which maketh the lower part of a hole through which the coniugations of the nerues are led. *ε* 7, the vpper part of the ſame hole.

laterall proceſſes [table 20.figu. 5,6,7.[b]] which are ſhort and obliquely perforated [table 2.figure 7.[c]] his backward proceſſe bifurcated [table 20.figure 5,6,7.[z]] becauſe of the muſcles,& beſide his aſcending proceſſes lightly bunching out,and his deſcending [tab.19.fig. 2.[R] tab.20.fig.6,7.[d]] lightly hollowed;beſide all theſe(I ſay)there ariſeth out of the middle of his body an appendix commonly called a proceſſe which is round and long [table 19. fig.2.3.4.O table 20.fig.6.[&] fig.7.O.] and is called ὀδοντοειδὴς becauſe it is like that tooth of a man which we call the Dog-tooth. The ſurface of this tooth is ſomewhat rough,to giue an originall to a ligament [table 19. fig. 5.[x]] whereby it is tyed to the occipitium : it is alſo compaſſed with a round and ſolide ligament [table 19.figure 5.[x]] leſt the marrow ſhould be compreſſed : it is alſo ioyned with the firſt by a broad ligament [table 20. fig. 5.[F]] compaſsing it about. His tooth.

The third ſpondell of the necke [table 19. fig. 2,3,[ss] Table 20. fig.8,9,] which is called ἄξων (and groweth together very firmely on the foreſide with the other foure) as alſo the 3. following haue their laterall proceſſes bifurcated or forked [Table 19. fig. 2.[vv] fig.4.[β]]becauſe of the implantation of the muſcles. But the ſeauenth ſpondell [table 19.figure 2,3, 4. character 7.]is like the rack-bones of the cheſt,and his backward proceſſe is not alwayes forked [table 19.fig,2.4.[x]]but ſometimes whole, the body below is playne that it may fully ioyne with the following *vertebra*. The 3. ſpondell. The ſeuenth.

All of them (except the firſt)haue appendices betweene which doe run thicke and ſoft griſtles to make them more nimble and free. Their *appendices*.

And thus much ſhall ſuffice for the bones of the cheſt in this place ; where alſo we will put an end to the Hiſtory of the middle belly, and proceede to the Controuerſies concerning the ſame.

¶ A Dilucidation or Expoſition of the Controuerſies concerning the Cheſt and Heart, &c.

QVEST. I. *An Anatomicall demonſtration concerning the Phrenſie of the Midriffe.*

THE ancient Phyſicians before *Plato*,did not call the Midriffe *Diaphragma*, but φρένες, not becauſe there was in it any ſeate of wiſedome which the Greeke worde ſignifieth, but becauſe when this muſcle is inflamed, preſently followeth the diſeaſe called *Phrenitis* or the phrenſie, which is a continuall abalienation or diſtemper of the minde,ioyned with an acute feuer and want of reſt or ſleep. The inflamations of many parts breede this deliration as of the liuer,the Stomacke and the Lungs;but ſuch diſtemper is but vncertaine and at ſome times not continual,only the inflamation of the midriffe breedeth a perpetuall or continual phrenſie,which ſo neerely reſembleth the true phrenſie ariſing from the inflamation of the brain and his membranes,that it may deceiue a Phyſicion vnleſſe he be right skilful : we wil deliuer in this place the ſignes how they may be diſtinguiſhed. They are therefore diſcerned the one from the other by reſpiration, by the voyce and by the handling of the *Hypochondria*. The true and primarie phrenſie which commeth from the inflamation of the braine or his membranes, maketh the reſpiration great, and that is deepe and long, that is ſeldome and rare with much diſtance betweene the breathings : but in the phrenſie of the midriffe the reſpiration is ſmall and frequent or quicke,ſmall or ſhallow,becauſe the inſtrument of reſpiration is inflamed,ſo that the cheſt cannot moue or be inlarged in all his demenſions in inſpiration,nor yet be freely collected or gathered vp together in expiration, as it may be in the former,where the inſtrument of Why the midriffe is called *phrenes*. What is a phrenſie. How the phrenſie of the midriffe is diſtinguiſhed from that of the Liuer,& other parts. How from the phrenſie of the braine. How by the reſpiration.

breathing is not taynted or violated, but onely the brayne: frequent also it is and quick, often returning, because of the necessity imposed by the flame of the ague; for so the shallow breathing is recompenced by often breathing.

How by the voice.

Secondly, these phrensies are distinguished by the voyce: for in the phrensie of the brayne the voyce is base, they cry out, spurne and byte any that comes neere them: contrariwise in the phrensie of the midriffe the voyce is acute or treble, because the chiefe instrument of free respiration is affected, and being drawne vpward by the inflamation, the chest becommeth narrower; for the magnitude and basenes of the voice followes the constitution of this instrument.

How by the retraction of the *Hypochondria.*

The Anatomical demonstration.

The three demonstratiue signes of the pluriſie from the midriffe.

Why when the midriffe is inflamed, there followeth a phrensy

The last and most proper signe of this phrensie of the midriffe, *Hippocrates* deliuereth in the 51. Aphorisme *Coacarum pænotionum*, where he sayth: In these men their *Hypochondria* appeare *intro ſurſum revulſa. i.* to be drawne inward and vpward: the demonstration of which saying is to bee made by Anatomy thus: The midriffe in the vpper side is couered with the *pleura*; on the lower with the *Peritonæum* or rim of the belly, which incloseth as in a sacke all the naturall instruments and parts conteyned in the lower belly, and giueth euery one of them his owne coate. The midriffe then being inflamed, is drawne vpward, and carrieth with it the *peritonæum*, with the *peritonæum* are the *hypochondria*, the Liuer, the Spleene, the Stomack, and all the bowels retracted; also hence comes that inward and vpward revulsion of the *Hypochondria Hippocrates* mentioneth: wherefore these are the three proper and demonstratiue signes of the phrensie from the midriffe: small or shallow and frequent respiration, a shrill or treble voyce, and the vpward and inward revulsion of the *Hypochondria*. But why happeneth it, that when the midriffe is inflamed, there followeth a phrensie? Some thinke that when the midriffe is inflamed, the brayne is also presently alike affected; for the inflamation of the midriffe hindering respiration, the heat is increased in the chest and the heart, the bloud is attenuated and groweth cholerick and flyeth vp into the brayn, whence commeth an *erisypelas*, that is, a cholericke inflamation of the brayn, the immediate cause of the true phrensie; but these things are ridiculous. For if it were so, then whensoeuer the Lungs also are inflamed, presently a perpetual phrensie would follow; because there followeth both a difficulty of breathing, and the Lungs are nourished with a bilious, that is, a very thin bloud: moreouer, if an *Erisypelas* should breede in the brayne, then were the phrensie a true phrensie, & not depending vpon the inflamation of the midriffe. Others referre the cause of the phrensie to an analogy or proportion in all correspondency betweene the midriffe and the brayne. But because the marrow of the backe is more correspondent to the brayne, and yet when that is inflamed, there followeth not alwayes a perpetuall phrensie, we doe worthily search farther for the cause. Wee therefore vnderstand that there is a double concurring in this busines, to wit, a wonderfull connexion and society of these two parts, and then the perpetuall motion of the midriffe. The society is by nerues, which communicate both heate and a vaporous spirite to the brayne. And the continuall and strong motion of the midriffe drieth vp with force and violence smoaky vapours to the brayne. For if you onely admitte the society or sympathy of the nerues, why should not the same phrensie fall out when the mouth of the stomacke is inflamed, which hath notable stomachicall sinewes which from the brayne are inserted into it?

The true cause.

QVEST. II. *Of the motion of the Heart and the Arteries or Pulse, a Philoſophicall diſcourſe.*

Euery man carries a perpetuall motion about him

THE busie wit of man obseruing the perpetuall motions of the heauens, hath long trauelled to imitate the same, and in making experiments, hath framed excellent and admirable peeces of workmanship, whilest euery one carried a perpetuall motion about himselfe, which happly hee little remembred or thought vpon, and that is the perpetuall motion of the heart, which from the day of birth, til the day of death, neuer ceaseth, but moueth continually: by what engines & pullies, what poyses and counter-poyses, what affluencies and refluencies this perpetuity is accomplished, we imagine will neither be vnprofitable nor vnpleasant to vnderstand, especially to those who desire to know and acknowledge the admirable workes of God in this little world of the body of man, as wel as his great administrations in the greater. We read of *Aristotle*, that when hee was in banishment in *Chalcide*, and obserued the seauen-fold Ebbing and Flowing in one day & a night of the *Euripus* or narrow *Frith* between *Aulis* and the Iland *Eubra*, and could not finde out the cause of it, he pyned away euen to death with for-

The cause of *Aristot.* death.

ſorrow. Me thinks therefore that euery man when he puts his hand but into his boſome and feeleth there a continuall pulſation, by which hee knoweth his owne life is gouerned, ſhould alſo bee deſirous to vnderſtand what maner of engine this is, which being ſo ſmall that he may couer it with his hand, hath yet ſuch diuerſities of mouing cauſes therein, eſpecially conſidering that a little skill to cleere and dreſſe the wheeles may keepe this watch of his life in motion, which otherwiſe will furre vp and ſtand in his diſſolution. We will therefore a little payne our ſelues, to diſcourſe of the manifold difficulties wherein the cauſes of this motion are ſo intangled, that ſome not meerely learned haue thought, that they are onely knowne to God and Nature and to none other.

The heart cõpared to a ſmal watch.

The motion therefore of the heart is double; one naturall, the other depraued. The naturall we call the Pulſe, the other we call Palpitation: the one proceedeth from a Naturall faculty, the other from an vnnaturall diſtemper: the one is an action of the heart, the other a paſsion. Our diſcourſe ſhall be onely of the naturall motion which conſiſteth of a dilatation called *Diaſtole*, a contraction called *Syſtole*, and a double reſt betweene them.

The motion of the heart double. The natural motion.

Ariſtotle imagined the onely cauſe of this motion to be heate, but perpetuated by the continuall affluence of oylie moyſture, which as continually is conſumed as it is miniſtred, euen as oyle put to a lampe: but the dilatation (ſayth hee) commeth from ebullition or boyling of the bloud, whereby it riſeth and occupieth a larger place, yea and powreth it ſelfe out into all the cauity adioyning thereto: and this he illuſtrateth by an example taken from boyling water; water when it boyleth riſeth vp and occupieth larger place then it did before, but if you blowe cold ayre into it, it preſently falleth; right ſo is it (ſayth he) in the heart of a man the heate boyleth vp the bloud, and the cold ayre we draw in by inſpiration ſettleth it againe: and this is farther proued becauſe the pulſes of yong men are more liuely and ſtronger then of old, of whole men then of ſicke, of waking men then of ſleeping, becauſe their heate is more vehement, and the feruor or working of their bloud more manifeſt. Theſe things are very probable, and carry (I muſt needs ſay) a great ſhew of trueth, but if they be weighed in the ballance of Anatomy they will bee found but light. Herein was the Philoſophers error that he vnderſtandeth the heart to be diſtended or dilated, becauſe it is filled: contrariwiſe, the Anatomiſt vnderſtandeth the heart to bee filled becauſe it is dilated.

Ariſtotles conceite of the cauſe. A pregnant example. Another inſtance. Wherein was the Philoſophers error.

In the depraued motion or palpitation of the heart it is diſtended indeede, becauſe it is filled either with water or with vapours, but in the proper and naturall it is dilated by an inbred power of his owne, and being dilated drawes in bloud and ſpirits, and ſo is filled, like as a Smithes bellowes being opened by the power of the ſmith is filled with ayre whether hee will or no; bladders whileſt they are filled are diſtended, thoſe fill in the dilatation, theſe dilate in the filling.

Comparison.

Beſide this conceite of *Ariſtotles*, others haue diuerſly deuiſed concerning this motion. *Eraſiſtratus*, *Hiracledus*, *Erithreus*, conceiued that the motion of the heart was from the Animall and vitall faculties together. *Auerrhoes*, that it was from the appetent and ſentient ſoule; and that the heat was but the inſtrument which the appetite vſed: others thought that nature onely moued the heart, becauſe alone it is ſayd to bee *principium motus*, or beginning of motion in thoſe things that are moued: others, that the dilatation of the heart was from the ſoule, and the contraction meerly naturall, the ſides of the heart falling down with their owne waight, like as in the diſeaſe called *Tremor*, or the ſhaking palſie; the facultie of the ſoule continually rayſeth vp the heade, and the waight beareth it downe againe, whence the perpetuall ſhaking proceedeth.

Eraſiſtratus. *Hiracledus*. *Auerrhoes*. Other opinions. The cauſe of the ſhaking palſie.

But trueth is, the motion of the heart is no trembling but a conſtant and orderly motion; neither is the contraction cauſed by the waight of the heart, it buckling vnder the burthen of it ſelfe, but the greateſt ſtrength of the heart is in the contraction, whereby it hurleth forth (as the lightning paſſeth through the whole heauen) his ſpirites into the whole body, and excludeth oftentimes not without violence, the fumed vapours into the arteriall veine. But before we ſet downe our reſolution concerning this matter, a few things are to be firſt eſtabliſhed.

The kinds of motions. Voluntary motions.

There is a threefold motion; Violent, Animal, and Naturall: of violent motions none at all can be perpetuall, whereupon wee may conclude that no Art can make a perpetuall motion. Animall motions are all voluntary: this *Galen* well deſcribeth in the fifth Chapter of his ſecond Booke *de motu muſculorum*, where he ſayeth, If thou canſt ſettle and appeaſe thoſe things that are moued or done at thy pleaſure, and againe mooue or doe that

was at reſt or was not done, that action or motion is truely voluntarie; if moreouer thou canſt doe any thing ſwifter or ſlower, oftner or ſeldomer at thy pleaſure, theſe actions are obedient to thy will. Finally, the Naturall motion is manifold, as a thing may diuers waies be ſayd to be naturall.

Natural motions manifold.

There is one ſimple naturall motion which is accompliſhed only by nature and the Elementary forme; with this motion heauy things moue downeward, and light things vpward.

Secondly, all motions are called Naturall which are oppoſed to violent motions; ſo the motions of the muſcles, though they be voluntary, are ſayd to be naturall, if they be naturally diſpoſed.

Thirdly, all motions are called Naturall which are not Animall, that, is voluntarie: So *Galen* ſayeth in the place before quoted, that the motion of the heart is not of the ſoule, that is, of the will, but of nature: & againe, the motion of the heart is of Nature, the motion of the cheſt, of the Soule.

So that *Galen* in his 7. Book *de vſu partium*, deliuering but two kinds of faculties, the one Animall, the other Naturall, vnderſtandeth all that to be Naturall which is not Animall or voluntary. Now we conclude, that the motion of the heart is Natural in the third acception; that is, that it depe deth neither vpon the will, nor ſimply vpon Nature; but vpon the vitall faculty of the Soule which is Naturall: not vpon the wil, becauſe wee can neither ſtay it nor ſet it going againe, neither ſlacken nor haſten it at our pleaſure: not ſimply vpon Nature, for in a body that is animated, that is, that hath a Soule, nothing mooueth but the Soule, otherwiſe there ſhould be more formes then one, and more beginners of motion then one, which true and ſolid Philoſophy will not ſuffer. This Soule is the Nature it ſelfe of the Creature, which that it may preſerue the vnion between the body and it ſelfe, moueth the heart, concocteth in the ſtomacke, reboyleth in the Liuer, and perfecteth the bloud in the veines. When we ſay therefore that the motion of the heart is Naturall, wee meane that it is from a naturall faculty of the Soule which is not voluntary. And that this motion is natural, all the cauſes of it do euidently ſhew.

The reſolution of the queſtion.

Three immediate cauſes of the pulſe.

There be three immediate cauſes of the pulſe, the Efficient, the End or finall cauſe, and the Inſtrument, all Naturall.

The efficient.

The Efficient cauſe is the vital faculty, which imploieth it ſelfe wholly about the generation of ſpirits, which by that perpetuall motion are brought foorth, for in the *Diaſtole* or dilatation it draweth bloud and ayre. In the *Syſtole* or contraction it draweth out the ſpirits already made, and their excrements.

The Final.

The Finall cauſe (which you may call either the vſe or the neceſsity at your pleaſure) is three-fold; the nouriſhment of the ſpirituous ſubſtance, which is kept in the left ventricle of the heart; the tempering and moderating of it (for there was great danger, that becauſe of the continuall motions the heart ſhould be inflamed, vnleſſe it had beene ventilated with ayre as with a fan) and the expurgation of ſmoky or fumed vapors.

The inſtrument.

That the nerue helpeth not the motion of the hart

The Inſtruments alſo of this motion are Natural, not Animall. *Galen* calleth the Animall inſtruments, the Muſcles and the Nerues: the heart is no muſcle, vnleſſe wee ſpeake abuſiuely, becauſe of the faſtnes and colour of his fleſh; and for nerues there are none that reach vnto his ventricles. There is indeed a ſmall ſurcle or tendrill from the ſixt coniugation that maketh the Recurrent, which is diſſeminated in the purſe and Baſis of the heart, but the heart ſtandeth in no need of it for his motion; for if this nerue be intercepted with a ſtring, or (which is the ſureſt way) his originall which is eaſily perceiued by the ſides of the weazon; yet neuertheleſſe is the heart moued as alſo the arteries, as in Dogges we haue often made experiment. Seeing therefore all the cauſes of the hearts motion be Naturall, we may conclude that it ſelfe is natural, comming from the vitall faculty which is not voluntary.

The firſt obiection.

But that the trueth of this concluſion may more playnely appeare, ſome obiections muſt bee anſwered, which otherwiſe would breede ſcruple in the mindes of them that are not ſo ſufficiently grounded in theſe ſecrets of Nature.

Anſwere.

Firſt therefore ſay ſome, all naturall motions are continuall; but the motion of the heart is interrupted with a double reſt, one betweene each motion. Let vs admit that one ſimple Naturall motion is continuall: yet when there are two natural motions and thoſe contrary, there muſt needs be a reſt betweene them.

The ſecond. Anſwere.

Secondly, they ſay, no natural motion is compound: but the motion of the heart is compound. I anſwere, The motion of the heart is not compound, but double; not ſimple, be-

becauſe of two contrary motions cannot be made one compound motion; neither of many motions is made one motion as one line of many poynts.

Thirdly, they vrge vs further thus, with *Ariſtotle* in the 7. Booke of his *Metaph.* Whatſoeuer is moued by Nature is moued to ſome end, which end when it hath obteyned, then it reſteth; as water being heated, if by it own force and proper forme it be cooled, neuer groweth hot againe by the ſame forme or force. Wherefore if the heart be moued naturally, it is mooued that it may be dilated or contracted; when therefore it is dilated, why is it contracted? and when it is contracted, why is it dilated againe? I anſwere, that that is true in a motion that is purely and meerely naturall; but the motion of the heart is from the vitall faculty of the Soule, which hath a naturall inſtinct and knowledge of his owne vſe, and according to the diuers appetites of that naturall inſtinct moueth diuerſly. For when the heart is contracted, it deſireth to be dilated that it may draw in cold ayre, when it is dilated or diſtended, it deſireth to be contracted to auoyde the ſmoke and ſoote that by his heate are ingendred: ſo the vitall faculty of the Soule which is ſenſible of his owne want, moueth the heart perpetually with diuers motions, according as the needs of the Soule do require. By which this motion of the heart is diſtinguiſhed from other motions of the Naturall faculty of the Soule, to wit, of the wombe and the ſtomacke. For the motion of theſe parts is not perpetual, becauſe there wanteth a perpetuall obiect, neither doth any neceſſity vrge, the finall cauſe it is not alwayes at hand, but the heart hath a continual obiect, neceſſity and end: for it wanteth perpetuall nouriſhment, tempering and expurgation. Finally, they contend that the motion of the heart is not Naturall, becauſe it is to two contrary poynts, but oppoſite and contrary motions are onely performed by the Animall faculty: ſo the arme is lifted vp and pulled downe onely by the will. I anſwere, that in things without life this is true, but all things that haue life, yea euen in plants themſelues there is motion to contrary poynts. I ſay more, there is neuer in the Soule one motion, but preſently reſulteth another oppoſite or contrary vnto it: ſo in nutrition, the attraction of the Aliment is from the Soule, ſo is alſo the expulſion of excrements from the ſame Soule. The Soule is ſo diuine a thing, that not only it doth many things beſide the lawes of other formes, but alſo is the author of contraries; for it moueth vpward and downeward and beyond the Nature of Elements, to the right hand, to the left, and circularly. The motion of the earth is ſimple and vniforme, the motion of the Soule manifold, becauſe the forme of the earth is one and ſimply ſimple. The Soule is ſimple, manifold, and *manifold wayes*: Simple in his Eſſence, manifold in his Power and Vertue, and manifold wayes in his knowledge of obiects, from which his operations and actions are drawne.

The third.

Anſwere.

How the motion of the heart differeth from that of other parts.

The fourth. Anſwere.

The diuinity of the Soule.

Multiplicity

We therefore conclude that the motion of the heart is Naturall, and proceedeth from the vitall faculty for a certaine end and purpoſe of Nature, and that it doth ſo procede, theſe two arguments doe neceſſarily auerre.

The concluſion.

Firſt, becauſe in the dilatation there is a certaine and determinate kinde of bloud and ayre drawne perpetually through the ſame ſet and determinate veſſels. In the contraction likewiſe the ſmoky ayre and the ſpirits are thruſt out by certayne veſſels.

Secondly, becauſe the fleſh of the heart is wouen with all kindes of fibres. If therefore thoſe ſeuerall fibres doe in other parts ſome draw, ſome contract, and ſome looſen, either they are ſuperfluous in the heart (which to ſay, is to blaſpheme Nature) or elſe they haue the ſame vſes in the heart that they haue in other partes. VVee ſayed it proceeded for a certaine end, becauſe this faculty neither worketh *voluntarily* as the Animall, nor according to the power of the Agent in reſpect of that which ſuffereth, but for meere neceſsity. The ſtomack, although it be not hungry, yet it concocteth ſo much meat as is put into it, if it can: but the heart is not moued but as neceſsity vrgeth, making a pulſe either ſwifter or ſlower, as the vſe of Nature is to haue a ſlow or quick pulſe.

QVEST. III. *Of the manner of the motion of the Heart, and whether it ſtrike the Breſt in the dilatation or in the contraction.*

THus much concerning the cauſe of the motion of the heart. It followeth now to ſpeake of the manner of his motion, which is better knowne by the eye then by diſcourſe of reaſon: wherefore it is vſual with Anatomiſts, for the better obſeruation of this motion, to open Dogs aliue, that they may more diſtinctly ſee the manner thereof. From this *Autopſia* and witneſſe of the eye will

The maner of the motion of the heart.

will we vnfold this myſtery.

The 2. motions of the heart.

There are two motions of the heart, *Dyaſtole* or dilatation, and *Syſtole* or contraction; betwixt each of theſe is a reſt or ceſſation, one following the diſtẽtion, the other following the contraction. For it is not poſsible that two contrary motions ſhould immediately ſucceed one another: but in the poynt of the refluxion or returne from one contrary to another there muſt needes be a reſt, otherwiſe there could be no beginning nor end of one motion diſtinct from the beginning and end of another; and ſo the motions could not be contrary which had no diſtinct beginning nor end particular to either of them, becauſe there is no reſt from which the beginning of the motion ſhould ariſe, or into which the end of the motion ſhould determine: wherefore whatſoeuer hath any reflexion, hath alſo ſome reſt before the reflexion.

The double reſt how neceſſary.

An inſtance in the tyde.

A manifeſt inſtance hereof wee haue in the Tyde, which when it hath flowed to his height, ſtandeth ſometime at a ſtay before it begin to Ebbe, which ſtay we call a high water when no motion of the tide can be perceiued. But what is done in theſe contrary motions?

Dyaſtole what.

In the *Dyaſtole* the heart draweth bloud by the gate of the hollow veine into his right ventricle, and ayre by the arteriall veine into the left.

Syſtole what.

In the *Syſtole* the heart driueth out vitall ſpirites into the great artery, or fumed and ſmoky vapours together, with a ſmall portion of the ſpirits, by the venall artery. In the *Dyaſtole* the ends of the heart are corrugated & contracted, the Baſis being drawne to the *mucro* or poynt, and the poynt to the Baſis: ſo that the heart becommeth ſhorter in his longitude, but is ſo amplified to his ſides, that his figure commeth neere to the ſpherical, which is the figure of moſt capacity. Contrariwiſe, in the *Syſtole* the ends of the heart are diſtended, but the ſides fall and flag, as it were, and ſo the heart becommeth longer, but narrower.

The vſe of the fibres of the heart.

Both theſe motions are performed by the helpe of the fibres; for the right which paſſe directly from the Baſis to the poynte, contracting themſelues make the dilatation. The tranſuerſe or circular ſtraighting the ſides, doe make the contraction; the oblique ſerue for retention, and make that double reſt whereof we ſpake. Againe, in the *Dyaſtole* all the values are extended, in which diſtention, the forked values make many chinkes or crannyes as it were, but the *ſemi-lunarie* values do cloſe vp the ends of their veſſelles. In the *Syſtole* all theſe membranes are contracted, and then the forked ſhutte thoſe chinks and crannyes which they made when they were dilated, and the *ſemilunarie* being corrugated or wrinkled, leaue ſuch diſtances or rifts by which the bloud freely paſſeth forth. Moreouer, the dilatation of the heart is before the contraction in time, for ayre is firſt drawn in before the ſmoky excrement is ſhut out: and againe, inſpiration muſt needs be firſt, becauſe expiration is laſt, for the life vaniſheth in expiration.

How the values are in the motions.

Greater vſe of expiration then of inſpiration.

But whether is of greater neceſſity? VVe anſwere, that in hayle bodies they are of alike neceſsity. In Agues eſpecially rotten and putrid there is more neceſsity of expiration, as wee ſee in thoſe that dye, their *Syſtole* and expiration is greater, becauſe Nature is more diligent to exclude that which is hurtfull, then to drawe that which is profitable; now wee know that the ayre that is drawne is familiar to the heart, but the ſmoaky and ſooty excrement is an offence vnto it.

Whether the heart ſtriketh the breſt in the *Dyaſtole* or in the *Syſtole*.

Laſtly, it is queſtioned whether it ſtrike the breaſt (which wee feele with our hand about the left breſt) in the dilatation or in the contraction. *Galen* ſeemeth to differ herein from himſelfe: for in one place he ſaith, *Quando rurſum euacuatum fuerit Cor, & in naturalem figuram recurrerit, tunc proſilit pectori, et percuſsionem facit, et ita concidens pulſum perficit*: that is, Againe when the heart is emptied, and returneth to his naturall figure and poſition, then it leapeth againſt the breſt, and maketh that percuſsion, and ſo falling accompliſheth that pulſe.

Galens authority.

Reaſon to the authority.

To this authority may bee added this reaſon: when the heart is dilated it becommeth ſhort, and againe long when it is contracted. VVherefore when it is diſtended it goeth from the breſt, and when it is contracted it flyeth to the breſt, and ſo ſtriketh it: beſide, almoſt all Anatomiſts ſay, that the fleſh of the heart is more ſolid in the *mucro* or point, then in the Baſis; that in the violent motions of the breſt it ſhould touch the bone, to which it is very neere, and ſo be hurt, & ſo vitiate his motion: the point therefore ſtriketh the breſt, but experience and waight of reaſon is on the contrary part.

The conſent of anatomiſts.

What the trueth is.

The reaſons to proue it.

The reaſons are theſe: If you lay one hand vpon the breſt, and another vpon the wreſt, you ſhal perceiue in either place at the ſame time the ſame ſtroke; and this both *Galen* hath obſerued in the 3. ch. of his 3. Book *de præſag. expulſ.* & we daily proue it true by diſſections

of

of liuing creatures; but it is most certaine, that the stroke of the artery is in the ende of the dilatation, for the end of the contraction cannot be felt; therefore that stroke of the heart we feele, is the end of the dilatation, not of the contraction.

It may bee obiected, that when the arteries are distended, the heart is contracted, and when the heart is contracted, then are the arteries dilated; if therfore you place your hand vpon the wrest or the temples, and there finde the stroke of the artery, and with the other hand vpon the breast finde also the stroke there at the same time, it must follow necessarily, that the heart is then contracted when the arteries are dilated, but the vanity of this obiection shall appeare in the next exercise. For the heart and the arteries are distended at the same time and in the same motion. Obiection. Answere with reference.

Moreouer, if the heart when it is contracted should strike the breast with his mucre or poynt, the stroake should not be felt at the left breast but somewhat lower, for the point of the heart reacheth to that place of the chest into which the midriffe is inserted. The brest therefore is beaten not with the poynt of the heart, but with the left ventricle when it is distended, which is the originall of the arteries; for when the poynt is gathered to the Basis in the *Diastole*, the heart is made larger, and so striketh the breast at the left Pap; but when it is contracted, the heart becommeth longer & narrower, and so falleth back into the chest; and of this also is *Galens* opinion in his Anatomicall administrations, and in those golden Hymnes of his, of the vse of the parts. Let vs proceed to the other difficulties which concerne the motion of this heart and arteries.

QVEST. IIII. *By or from what power the Arteries are moued.*

THE motion of the Arteries *Hippocrates* first of all others called σφυγμὸν, that is, the Pulse, & although he left indistinct precepts about it, yet was it not vtterly vnknowne vnto him, as some nouices would beare the worlde in hand, which may be prooued by many places, if it were necessary to wrastle in that floore: but we list not insist in that, but proceed. That the forme of the motion of this pulse is all one with that of the heart; for it consisteth of a *Diastole* and a *Systole*, and a double rest. *Hippocrates* first found the pulse and so named it. The forme of the motion.

In the *Diastole* the Arteries draw and are filled, and in the *Systole* they expell. The rest is double, vnlesse Nature bee prouoked either by a violent obiect, or by some external cause; for then the arteries may be moued together with an insensible rest, as in the pulse called *dicrotus ad vibrans*: so a stone which is throwne vpward, if it meet with a falling Tower, descends againe without any rest, although *Aristotle* thinketh that no violence can tie to contrary motions without some rest. *Aristotle.*

The vse of this pulsation is double; one greater, another lesser. The greater is for the conseruation of the naturall heate as well of the heart as of other parts: for by contractions whatsoeuer is smoky the arteries auoyde, and so the naturall heate is kept from suffocation, by dilatation they draw outward ayre into the body, by which the dissolution of the same heate is inhibited. The vse of pulsation double.

The lesse vse is, that in the braine may be ingendered the Animal spirit, for by the pulsation the spirits of life are carried into the *plexus choroides*. There is therefore the same vse of the pulse that there is of respiration, sauing that what respiration doth to the heart, that the pulse of the arteries doth to other parts, which as they neede lesse heate then the heart, so are they not so soone offended: for if the heart bee depriued of respiration, presently the creature perisheth, but the part dyeth not as soone as it wanteth the pulse.

The nature of the motion of these arteries is very obscure, and many things must bee resolued of and known, before we can attayne to the vnderstanding of so deepe a mystery. First of all, whence are the arteries moued from themselues or from some other. *Prapagoras* thought the arteries did moue of their owne accord, and that they had the same pulsatiue vertue that the heart hath, in themselues, not by influence. But this *Galen* disproueth by an obseruation; for sayth he, if an artery be cut ouerthwart, that part onely will pulse which remayneth ioyned to the heart; but that which is separated from the heart, will not beate at all. The nature of their motion obscure. *Prapagoras.* *Galens* instãce

Erasistratus was of minde, that the arteries were not mooued by any proper power of their owne, but by the constraint of the heart, and that constraint hee meaneth not of any faculty but onely of some matter. *Aristotle* thought they moued, because of the feruour or boyling of the bloud contayned in them, whome some haue followed, because they know that *Erasistratus.* *Aristotle.* The reasons.

Neither heat, nor ſpirits, nor bloud, are the immediate cauſes.

that the ſpirits are thoſe which make ſtrife & offer violence; and again, becauſe the veines neere the hart do not móue, which they would do (ſay they) if they had in them ſuch bloud as the arteries haue: but we will proue that neither heate nor ſpirite, nor boyling bloud can be the immediate cauſe of this perpetuall motion. For the heate, it either hath a body or hath no body; if it had a body, then the arteries that are neerer to the heart would ſooneſt be dilated; if it be onely a naked quality, then will it firſt heate thoſe things that are neere hand, and after that which is farther off. For heate is not of the number of thoſe formes which may in a moment be diffuſed as light, but his contrary is cold, which firſt muſt be expelled out of the ſubiect before it ſelfe bee receiued: but the pulſe is in a moment diffuſed through all the arteries, it is not therefore only from heate.

Not heat.

Not bloud.

It is not of ſpumous bloud; for then it would follow that where the bloud is more plentifull and hotter, there the pulſe ſhould be not onely more vehement, but more frequent alſo; and ſo the pulſes of the great arteries ſhould bee quicker then the pulſes of the ſmall: but experience teacheth, that all the arteries both great and ſmall doe mooue alike vnleſſe there be ſome hinderance; they are not therefore moued by the bloud contayned in them.

An inſtance.

Furthermore, intercept an arterie with a tye, and the part below the tye, though it ſtrut with ſpirits and thinne bloud, yet will not beate, becauſe the continuity of the faculty with the heart is intercepted; but as ſoon as the tye is vnlooſed, the artery will inſtantly beate againe, but the heate nor the humour can in a moment or inſtant flow from the heart into the vtter arteries. Adde to this, that if the arteries ſhould beate becauſe of the bloud contayned in them, then in all large pulſes there ſhould alſo be vehemencie, which is nothing ſo: For ſayth *Galen* in his Booke *de vſu pulſuum*, and in the fourth *de cauſis pulſuum*, there is a pulſe which is ſmall yet vehement, and there is likewiſe a pulſe which is great but languid and faynt, which variety cannot come from the heat.

There may be great, yet a faint pulſe.

Aſclepiades his opinion.

Aſclepiades acknowledgeth a faculty in the motion of the arteries; but whereas this motion is in dilatation and conſtriction, hee affirmeth that the diſtention onely is from the faculty, and the contraction from nature; that is, from the predominant element and from the waight, becauſe when the creature is dead the arteries doe fall. So bladders if they be filled with any thing they are diſtended, but they fall of themſelues: and all round and hollow bodies are dilated by ſome facultie, but afterward doe fall with the waight of their owne parts. On the contrary, thoſe things that are contracted by any faculty, that faculty ceaſing, they are againe dilated. Therefore if the arteries bee dilated by a faculty, then are they contracted by their grauity, and ſo on the contrary: wherefore they need not a faculty for both.

Herophylus his opinion.

Herophylus quite contrary will haue the contraction to be performed by a faculty, but the dilatation (ſayth he) is nothing elſe but the returne of the arterie to his natural poſition: Becauſe ſayth he, the arteries of dead carcaſſes being caſt into hot water, when they haue gotten the meaſure of heate that they had in the liuing body, will be dilated, but neuer fall, becauſe there wanteth a faculty: but they are both deceiued.

How both were deceiued.

For if both the *Dyaſtole* and *Syſtole* came not from the faculty, but from the conſtitution of the artery, then the artery ſhould euer keepe the ſame magnitude, and the ſame vehemencie of pulſation; but we ſee that the pulſe is now greater, now leſſer, as the ſtrength is great or little; ſometimes the *Syſtole*, ſometimes the *Dyaſtole* is greater, as the vſe of either is increaſed. There want not ſome who ſtriue to prooue that the motion of the arteries is from the brayne, ſtanding vpon one authoritie of *Galens*, where hee ſayth in the 2. Booke *de cauſis pulſuum*, When in a man the pulſe beginnes to be conuulſiue, preſently he is taken with a conuulſion, which ſeemeth to intimate, that there is one originall of the faculty of pulſation, and of that to which conuulſion doeth belong. But *Galens* owne obſeruation bewrayeth the vanity of this opinion. For if the brayne be compreſſed, ſence and motion will periſh, but the arteries will ſtill beate. If the nerue which commeth from the brayn to the heart bee cut or intercepted, the creature becommeth dumbe, but the arteries beate ſtill.

That the motion of the arteries is not from the braine.

The true cauſe whereby the motion is moued.

Seeing therefore that the arteries neither moue by a power of their owne, nor from the Elementary forme, nor onely from heate, nor from a ſpirit or ſpumy bloud, it remayneth neceſſary that they ſhould be mooued by pulſatiue power of the heart. For if they ſhould be moued by any thing ſaue by a faculty, their motion ſhould be not continual but violent: neither would there bee any attraction of ayre in dilatation, but the boyling bloud would take vp all the roome.

This

This Faculty or power pulsatiue is in a moment carried, not through the Cauitie but along the coats of the Arteries; and that it is carried in a moment this is an argument that all the Arteries are mooued with the same motion, all together in the same time vvhen the heart is mooued. If it be obiected, that *Galen* (in the 1. *de different. pulsuum, & de 2 prima cognitione ex puls.* speaking of those that haue hot hearts, and cold Arteries in whom the parts of the Arterie that are neerer to the heart are dilated sooner then those that are more remote) is constrained to confesse, that the pulsatiue power is mooued through the arterie & slowly by degrees. I answer, that the faculty floweth in a moment vnlesse it be hindred. But it may be hindred sometimes by his owne fault, sometimes by the fault of the Instrument; by his owne when the heate is weake, by the instrument when the arteries are either cold or soft or obstructed. It remaineth therefore, that when al things are aright disposed it floweth in an instant, and not through the Cauitie, but along the coats of the Arteries. *Galen* in the last Chapter of the Booke *Quod sanguis Arterijs delineatur*, giueth an instance from experience. If you put a Quill or Reede into the Arterie, which will fill the whole cauity, yet will the Artery beate; but if his coats be pressed with a Tie, it will cease instantly. If it be obiected that the Arteries in an Infant beate before the heart, and therefore the pulse is from the spirit, not from the heart: I aunswere, that the Infants Arteries do mooue by a vertue that proceedeth from the heart of the Mother: for the Arteries of the infant are continuall with those of the Mother, and receiueth as well life & the pulsatiue Faculty from her, as the Liuer and all the other parts do nourishment.

Which waie the Faculty is led.

What may hinder the motion of the heart.

An instance for experiēce

Obiection. Solution.

QVEST. V. *Whether the Arteries are dilated, when the Heart is dilated, or on the contrary then contracted.*

A difficult question.

THere ariseth now a more obscure, thornie, and scrupulous question, then the former, and that is, whether the Arteries and the heart are mooued with the same motion. For the explication whereof, we must first resolue that the Arteries are filled when they are dilated, and emptied when they are contracted, that they draw when they are dilated, and expell when they are constringed. The reason is manifest; For the vessels must needs draw with that motion whereby they are made most fit to receiue; but the vesselles by how much they are more enlarged, by so much are they more capeable: now they are enlarged by dilatation; therefore, when they are dilated they draw and are filled: so that *Archigines* is no way to be hearkned vnto, who was of opinion that in the *Systole* the arteries do draw and are filled, and in the *Diastole* do expell and are emptied; whose argument for this was, because in inspiration the lippes are streightned, and the Nosthrils contracted: but whether this *Diastole* of the Arteries be at once and together with the dilatation of the heart, that is indeede a great controuersie. *Erasistratus* was the first that thought their motions contrary, that is, that when the heart is dilated, the Arteries are contracted; and when the heart is contracted, the Arteries are dilated.

The Arteries are filled in their dilatatiō

Archigines.

The first opinion.

Erasistratus.

Amongst the new writers, these haue sided with him: *Fernelius*, *Columbus*, *Cardane*, & *Scaliger*: and truely his opinion may be confirmed by authorities and reasons. *Galen* in his Booke *De Puls. ad Tyrenes* saith, that the Vitall Faculty dooth mooue diuers bodies at the same time with diuers motions, which can be vnderstood of nothing else but the motions of the heart and of the arteries. *Auicen Fen.* 1. *cap.* 4. *doctrin.* 6. affirmeth, that the vitall Faculty doth together dilate and constringe. The reasons beside these authorities are: In the *Diastole* the heart draweth blood by the hollow veine into his right Ventricle, and aer by the venall artery into the left. Therefore at that time the heart is filled, and the vessels are emptied. Contrariwise, in the *Systole* the heart expelleth the Vitall spirit into the arteries; therefore at that time the heart is emptied and the arteries are filled; but when the arteries are filled they are distended, and when they are emptied they fall: wherefore when the heart is distended, the arteries are contracted, and when it is contracted they are distended. Beside, there is the same proportion betweene the arteries and the heart, which there is betweene the heart and the deafe eare: but it is most certaine, which our eie-sight teacheth vs, that the motion of the heart, and of the eares of the heart are diuers; for when the heart is dilated, then those eares doe fall; and when the heart is contracted, then they are distended and filled: wherefore the heart and the arteries are mooued with a diuers motion.

Authorities.

Reasons.

The first

The second.

Thirdly, as attractions and expulsations are in other parts, so it is likely they are in the heart;

The third.

heart; but when the ſtomack driueth out the Chylus, the meſſentery veines do draw it, and therefore when the heart driueth out blood and the vitall ſpirit, then the arteries draw it; and ſo their motions are contrary.

The fourth. Fourthly, when the heart is dilated then becommeth it ſhorter, and draweth vnto it ſelfe the arteries that are continual with it and therefore maketh them narrower, but when the heart is contracted the arteries are dilated and become longer.

The fift. Laſtly, if one hand be placed vpon the breſt & another vpon the wreſt, the ſame ſtroke will at the ſame time be perceiued; but the ſtroke and percuſſion of the breſt is done by the contraction of the heart, for when it is contracted it commeth to the breſt and ſtriketh it: but when it is diſtended it becommeth ſhorter and recedeth from the Cheſt. Now the ſtroke of the Artery is not from the contraction, but from the dilatation. Wherefore the heart and the Arteries are moued with a diuers motion.

The truth it ſelfe proued by But notwithſtanding all theſe reaſons, yet are we perſwaded with *Galen* in his booke *de vſu pulſ. & 3. de præſag. expulſ. & 6. de vſu partium*, that the heart and the Arteries are moued with the ſame motion. And this we are taught firſt by experience; then by ſtrong & inuincible force of argument. The

Experience. experience is inſtanced by *Galen*, which euery man may make tryall of in himſelfe. If one hand be laide vpon the breſt and another vpon the wreſt, the ſame ſtroke will be perceiued at the ſame time; and beſide in diſſections of liuing creatures we haue often obſerued

Reaſon. First. the very ſame. But beſide, theſe reaſons doe euince it. We haue already proued that the arteries are not moued by the impulſion of the bloud, not by the boyling or heate of it, but by a faculty and that not of the Arteries but yſſuing from the heart; therefore they are contracted by the faculty which contracteth the heart and diſtended by the ſame force and power by which it is diſtended. But if they were moued with diuers motions, it would follow that the dilating faculty

Second. muſt flow from the heart in the ſame moment wherein it is contracted, which no Philoſopher will dare to admit. Beſide, that motion is the ſame which hath the ſame efficient and finall cauſes: but the pulſatiue power is the ſame which moueth the heart and the Arteries; and the end alſo is the ſame, to wit, nutrition, temperation or qualification, and expurgation.

Third. Thirdly, the motion of the part and of the whole is all one; and a part of that beeing

An inſtance. moued which is continuall with the whole, the whole is moued: as is ſeene in the ſtrings of Inſtruments: but the Arteries and heart are continuall together; wherefore if they bee moued by the heart as is moſt euident, then will it follow neceſſarily that they ſhall both be moued together by the ſame motion.

Fourth. Fourthly, vnleſſe the heart and the Arteries were together diſtended and together contracted, the hart ſhould not be refrigerated in his dilatations, becauſe the Arteries being contracted there would follow an excluſion of the ſmoky excrments into the left ventricle, and ſo the hart and the artery ſhould mutually ſtriue, & their motion be in vaine.

Fift. Fiftly, it would follow that in the contraction the heart ſhould draw ayre from the dilated and diſtended arteries. For ſometimes the vſe of reſpiration being taken away, as in paſsions of the mother; the hart doth not draw ayre from the Lungs and the venall artery, becauſe then no ayre is drawne in by the mouth and the noſtrils, yet the hart moueth and the arteries beate. Now it is moued for the generation of vitall ſpirits, but this generation is not without the admiſtion of ayre: it draweth therfore ayre from the arteries not contracted becauſe then are the excrements expelled, but from the arteries diſtended. But if when the arteries are diſtended the heart be contracted, then the contracted heart ſhall draw from the diſtended arteries, and ſo ſhall the motions of the heart become contrary.

Sixt. Sixtly, this faculty is incorporeall, communicating it ſelfe in a moment: wherefore at what time the hart beginneth to dilate, it diſtendeth all the arteries, and ſo on the contrary.

Seuenth. Finally, the pulſes which are in anger, ſorrow and other paſsions doe ſufficiently ſhew that the heart and arteries are moued with the ſame motion. For, if when the hart is dilated the arteries ſhould be contracted, then in anger the pulſes ſhould bee ſmall, in griefe great; becauſe in anger the heart is ſomewhat contracted and therefore the arteries ſhould be but a little dilated. Contrariwiſe, in griefe the arteries ſhould be very much dilated becauſe the heart is ſtrongly contracted: but how falſe this is, common experience

What deceiued the former learned men. will witneſſe. Let vs therefore ſettle our ſelues in *Galens* opinion and determine, That the arteries are dilated and contracted when the heart is dilated and contracted.

The ſtructure of the veſſelles of the heart, deceiued thoſe learned men which hold the con-

contrary opinion, together with the obscure maner of the hearts motion. For there being in the Basis of the heart foure notable vessels: the hollow veine, the arteriall veine, the venall artery, and the great artery: they imagined that the heart in his *Dyastole* did draw something from these foure vesselles, and in his *Systole* driue something into them all; and that therefore in the *Dyastole* of the heart they were all emptied that the heart might bee filled, and in the *Systole* of the heart they were all filled because the heart is emptied.

Beside, they seeme to haue been ignorant of the Efficient cause of the motion of the heart and the arteries. For they would haue the heart and the arteries to bee dilated because they are filled with ayre or bloud. But the trueth is, that the arteries are not dilated because they are filled; but because they are dilated therefore are they filled: onely the power & pulsatiue faculty which floweth from the heart distendeth the arteries, not the bloud contayned in them. For whether they be distended or contracted they remayne alwayes full of bloud: but if you shall thinke that they are distended because they are filled, then will it follow that at the same time they cannot be all distended; for how can that corporeall bloud bee carried in a moment from the heart to the arteries of the foote? I will giue you for illustration of this matter an elegant example. The Smithes bellowes because they are dilated are therefore filled with ayre; and the chest because it is distended by the animall faculty is presently filled; but purses bagges and the hogges bladder with which boyes often play themselues, are distended because they are filled.

What the trueth is.

The arteries in both motions are still full of bloud.

A fit example

But we must carefully marke, that whereas there are foure vesselles of the heart, onely the arteries is filled because it is dilated: the other three are distended because they are filled, and doe fall because they are emptyed; because onely the arteries haue the motion of *Systole* and *Dyastole* from the faculty of the heart, the other vesselles are immouable. And this is the reason why when the heart is contracted the left eare is dilated, because the eare is a kinde of store-house of ayre and bloud which suddenly rush into it; from the which when the heart draweth bloud or ayre, it is of necessity that it should contract it selfe.

The former distinction concerneth only the arteries.

Why the left eare is dilated when the hart is contracted.

These things being determined, it will bee easie to make satisfaction to whatsoeuer is obiected on the contrary part. The authorities of *Galen* and *Auicen* are not contrary to our determination, for they call the heart and the arteries diuers moouable bodies, which at the same time are mooued with diuers motions; for they are dilated and contracted at once and together by the same vitall faculty. And I imagine that *Galen* and *Auicen* spake this against the antients, who sayde that onely the dilatation was from the faculty, but the contraction from the Elementary forme and from the waight of their bodies. The reasons are thus to bee answered. The arteries are not distended because they are filled but are filled because they are distended; neither doe the arteries fall altogether when they are contracted but retayne still their cauity; and the plenty of the matter is more which issueth from them then that which is receiued into them: the arteries therefore are not dilated by the influence of the matter which goeth out of the heart.

Satisfaction to the authorities alledged.

The reasons answered.

The first.

The second argument is of no moment: for there is not the same reason of the heart and the eares thereof; for the eares expell nothing, but the arteries expell more at that time then they receiue; beside, the eares are dilated because they are filled, but the heart & arteries are therefore filled because they are dilated: and this did *Hippocrates* silently insinuate where he sayth, The heart is mooued by his whole Nature, that is, by his proper faculty: but the eares doe priuatly swell and fall againe; that is, as they are filled or emptied of ayre and bloud.

The second.

Hippocrates de Corde expounded.

To the third reason we thus make satisfaction; in other parts the attractiue and expelling vertues are in-bred, but contraction and dilatation the arteries haue by influence.

The third.

The fourth reason instanceth but in a light contraction, which is into length not into bredth.

The fourth.

Last of all, the last reason is against experience, for we haue before proued that the brest is beaten in the dilatation, the left ventricle being largely displayed.

The last.

QVEST. VI. *Of the generation of the vitall ſpirit, and by what wayes the bloud goeth out of the right into the left ventricle of the Heart.*

Of the vitall ſpirit.

WEE haue hitherto prooued that the motion of the Heart and the Arteries is one and that a perpetuall motion, conſiſting of a *Syſtole* a *Dyaſtole* and a double reſt, ariſing from a naturall pulſatiue faculty of the Soule reſiding in the heart, there aſsiſted by the ſtructure of the fibres and thence deduced by influence or irradiation into all the arteries at one inſtant, not through the cauity but along their coates. Now becauſe a'l this curious and maiſter-peece is wrought by Nature, onely for the generation of vitall ſpirits; it is more then requiſite that we vnderſtand what this ſpirit is, & how generated. We will not trouble you with many things hereabout, but thoſe we will inſiſt vpon ſhall not be triuiall and ordinary but hewen out of the deepe quarries, vnueyled from amongſt the moſt ſecret myſteries of Nature. That there is a vitall ſpirit in perfect creatures no man euer denyed. *Hippocrates* in his Booke *de Generat.* & *de principus* firſt put vs in minde of it, *Galen* hath a thouſand times inculcated the ſame.

All phyſitians agree that there is a vitall ſpirit.

The prince of the Arabian tribe *Auicen* hath ſet his ſeale vnto it; and all the multitude of Greek and Arabian Phyſicians haue added their ſuffrages. And amongſt the later writers, though ſome haue doubted concerning the Naturall and the Animall ſpirites, yet all with a ioynt conſent allow of the vitall. There is therefore a vitall ſpirit which is primarily ſeated in the Left caue or denne of the heart as it were in a ſhoppe or work-houſe; and from hence it is diffuſed by the arteries as by conduits or pipes into the whole body. This ſpirit cheriſheth the in-bred heat of euery part, quickens it when it becommeth drowſie, bringeth it forth when it lyes hid, and being ſpent or waſted reſtoreth it againe.

The office of this ſpirit.

This ſpirit whileſt it ſhineth in his brightnes and ſpredeth it ſelfe through all the Theater of the body as the Sunne ouer the earth, it bleſſeth all partes with ioy and iolitie and dies them with a Roſie colour; but on the contrary when it is retracted intercepted or extinguiſhed, all things become horred wanne and pale and finally doe vtterly periſh. So wonderfulland almoſt ſo heauenly are the powers of the heat and ſpirit, that the diuine *Senior Hippocrates* applying himſelfe to the rude capacity of the people (as *Galen* witneſſeth, hee ſticketh not often to doe) calleth it the Soule, that is, the chiefe inſtrument of the Soule.

Hippocrates calleth the ſpirit the ſoule.

The Soule of a man (ſayth hee) is ſeated in the left ventricle and is nouriſhed not by meates or drinkes from the lower belly, but by a moſt pure and bright ſubſtance out of the ſeparation of the bloud; as if he ſhould ſay, it is creamed as it were off from the bloud, and by the heat of the heart rarified into an ætherial conſiſtence. For the Soule it ſelfe being a deniſon of heauen (τῆ γὰρ ἡμῶν γένος ἐσμέν, for wee are alſo of his generation) how could it be tyed to this houſe of clay vnleſſe it were by the mediation of ſome middle Nature, participating as neere as mortality will ſuffer of the puritie of the Soule and yet hauing his originall from the body, that the Soule might haue a nimble and agile inſtrument to follow her ſudden deſignes.

Paul. The ſpirit is the *medium* betweene the ſoule and the body.

By the Soule therefore in this place, *Hippocrates* meaneth the vitall ſpirite, which is nouriſhed with pure and attenuated bloud, that is, Reſtored; for therein lyeth a myſtery: that the nouriſhment of the ſpirit is not, in all things, like the nouriſhment of the partes, but rather is an illumination, vnition and eſtabliſhment of them, as wee ſhall heare afterward.

The vſes of the vitall ſpirit within & without the heart. *Calor influens.*

The vſes of this vitall ſpirite are according to his nature deuine alſo, both within and without the heart. In the heart to bee the principall inſtrument of the functions of the heart; without the heart his vſe is double: one to bee the ſubiect of the heat of the heart which wee call *Calor influens* the influent heate, which it may receiue as the ayre doeth the light and ſo exhibite it to the whole body; and the other to bee the matter of the Animall ſpirit.

His matter double.

This vitall ſpirit hath a double matter aery and ſanguine, for it is made as *Galen* ſaith in his ſeuenth Booke *de placitis Hipp. & Platonis*) of aer and blood mingled together. That it is made of aer *Hippocrates* taught in *Epidemijs* when he ſaith; Such as is the aer ſuch are the ſpirits; a foggie and cloudy aer engendreth a groſſe and duskiſh ſpirit: and againe *Hippocrates*; The Southwinds dull the hearing, are miſty and breed a diſſolution of the ſpirits.

Ayre.

This

This aery substance alone cānot contein within the body the vital heat; It is necessarie therfore that there should be an admistion of thin and subtle blood which should restraine the impetuous force of the aire. And both these matters before they come vnto the left ventricle of the heart stand in neede of preparation. The aire drawne in by the mouth and the nose is prepared in the Lungs his vessels and his whole soft rare and spongie substance, & by a long delay doth acquire a qualitie familiar to the in-bred spirite. This aire thus prepared, is conueyed by the venall Artery into the left ventricle. And this is the preparation of the aer, these the passages by which it is conducted to the heart.

Bloud.

How & wher the aer is prepared.

Concerning the preparation of the blood, in what place it is made and accomplished and by what waies it is deriued into the left Ventricle, the Anatomists do striue with implacable contention. I haue read and turned ouer many of the Monuments both of the Ancients and also of later Writers and I finde foure opinions euerie one repugnant to another.

How the blood is prepared.

4. Opinions.

The first and the most ancient is that of *Galen*. He thinketh, that the blood is carried through the Hollow veine which with an open mouth gapeth into the right ventricle of the Heart as into a Cisterne, and is there boyled attenuated and subacted, and then a part of it is sent by the arteriall veine into the Lungs & distributed into thē for their norishment, the remainder is carried through the middle partition, which like a wall seuereth the two Ventricles asunder, into the left, where it is by the in-bred vertue of the heart mingled with the aer and doth there acquire the forme of a vitall spirit, assisted partlie by the inbred spirit of the heart, partly by an exceeding heate & flame whereby it is wrought as in a Furnace into a more pure Elementary forme. This opinion of *Galen* which of all the test is most true, some of later times haue condemned. For they do not thinke it possible that in so short a time so great a quantity of blood as is sufficient for the generation of vitall spirits for the vse of the whole body can sweate thorough the wall of the heart into the left ventricle, there being no apparant and sensible passages, and the wall also beeing very thicke and solid.

The first and trueſt of *Galē*.

Obiections.

Moreouer they obiect, that if it should be so, then the labour of the heart were vaine and idle; for why shold not the blood and aire being thus attenuated repasse again out of the left into the right, seeing the same way is open for them, the same passages & no values or gates to hinder it? But these Obiections are of lesse weight then that they shold weaken the authority of so great an author of our Art: and *Galen* himselfe foresaw (in the 15. cha. of his 3. Booke *De Facultatibus Naturalibus*) that there would be some which would make these childish Obiections. Wherefore in another place he thus elegantly explaineth himselfe. Out of the right Ventricle that which is the thinnest is drawne through the pores or passages of the partition, whose vtmost ends can hardly be perceyued, because after death all such yea all other passages that are not distended by the matter conteined in them, doe fall together. But that it is this way transmitted hence it is manifest, because Nature neuer endeuoureth any thing rashly or in vaine; but there are certaine dens in the fence or partition, deep bosomes very many which grow narrower to their outlet, by which the blood may freely and with a large streame yssue out of one ventricle into another. But the cause why this blood doth not returne againe out of the left into the right side, may be well referred to the peculiar force and vertue of the heart.

Galens minde explained by himself.

The left Ventricle drawes this bloode and retaineth it by an inbred propriety and for a while enioyeth it, and then thrusteth it foorth into the Tunnels of the arteries. So the blood which either hath sweate through the coates of the veines, or is powred foorth at their mouths into the substance of each part, returneth not into the veines againe because it is reteyned and receyued into the substance of the part. The truth of this opinion, albeit it be most cleare of it selfe, yet it will bee better manifested vnto vs after wee haue taken knowledge of other mens conceites and discussed them to the full.

The second opinion therefore is that of *Columbus*. That the bloode indeede is attenuated and prepared in the right Ventricle of the heart, but is carried into the left ventricle by other passages and not through the pores of the *Fence* or partition. And what neede we seeke for so small and secret pores, when it hath an open channell, the arteriall veine, which (sayth he) carryeth all the bloud out of the right ventricle into the Lungs, where a part of it is distributed for their nourishment, the rest is returned into the venall artery and from it together with the ayre into the left ventricle; and this opinion of his he strengthneth with two reasons. The arteriall veine (sayth he) is greater then was necessary for the nourish-

The second opinion of *Columbus*.

ment of the Lungs, it is therefore like that it was destinated also for the conueiance of the bloud for the generation of the vitall spirits. His other reason is this: there is alwayes in the venall artery thinne and arteriall bloud; this bloud is receiued not from the left ventricle, for the three-forked Membranes wil not suffer it; therfore frō the veine of the Lungs.

The answere to *Columbus* his First reason.

These things are very probable and cloked with the vaile of truth, yet not to be admitted for currant. For whereas he saith the veine of the Lungs is larger then their small body stands in need of, we vtterly deny it. For the rare lax and spongy substance of the Lungs is easily dissipated, it is also continually moued, and by reason of the neighbourhood of the heart is easily inflamed; whence comes a huge expence of the threefold nourishment; but where there are great goings out, there also had need be great commings in: now the bloud could not come plentifully in but by a wide vessell, therefore the vessell of the Lungs was of necessity very ample and large. Besides saith *Galen*, Nature made this vessell large, that how much was abated in the nourishment of the Lungs by the vessels thicknesse, so much might be recompenced in his amplitude and largenes.

Lib. 6. de vsu part. cap. 10.

To the secōd.

To the second reason we may answere thus: The bloud that is found in the venall artery is a portion of the vitall sprits and arteriall bloud which the heart poured foorth into the substance of the Lungs: for all life being from the heart and the vitall spirit, and no deriuations of vessels from the great arterie vnto the Lungs; it is likely yea necessary that vitall spirits should bee conueyed to the Lungs by the venall artery, neither is there any reason they should obiect the opposition of the thre-forked Membranes; for there are but two in the orifice of this vessell, because it behoued not that it should bee perfectly closed vp.

An obiection. Answere.

Happly they may obiect the contrary motions and the mixture of smoky vapor with the spirits, but they attribute very little to the wonderfull prouidence of Nature and are ignorant what the diuers appetites and attractions of particular parts can do. The veines of the messentery do together and at once distribute Chylus and bloud: Milke passeth sometimes out of the brests all along the trunke of the hollow veine yet is not mingled with the bloud, but passeth out by vrine pure and sincere; and as we shall by and by proue, the matter and quitture of those we call *Empyici* is purged by the left ventricle of the heart and so through the arteries into the kidnies and the bladder, yet is not the vitall spirit stained with this filthinesse if all things be in good order with the patient: and so much for *Columbus*.

Pure milke auoyded by vrine.

The third opinion of *Botallus*.

The third opinion is that of *Iohn Botallus*, the french Kings Physition, who boasteth that he found a passage open which no man euer knew, out of the right deafe eare into the left, by which he imagineth that the bloud prepared in the right ventricle passeth into the left. This he saith is very euident in Calues and other young creatures, but in man & creatures that are growne, it is not so open.

Confuted.

This opinion of *Botallus* hauing no reasons to establish it, ouerthroweth it selfe; for if Nature made this passage for this vse, to transfuse the bloud from the right ventricle vnto the left; then should it be manifest in all creatures in all times of their life, yea the creature growing large and the naturall heat daily increasing the passage also should grow more manifest as whereof there is euery day greater vse. But *Botallus* confesseth it is not found in Oxen nor in creatures of any growth.

Beside, this passage is in the orifice of the hollow veine, how therefore should the attenuated bloud flow backe from the right ventricle vnto the veine, seeing there are three values open without and shut within, which doe admit the bloud indeed into the right ventricle but will not suffer it to flow backe into the hollow veine? This good honest man was ignorant of the vse of his passage, which *Galen* acurately describeth first of al men in his golden bookes of the vse of the parts.

Botallus ignorant of the vse of the passage he thinkes hee found.

My selfe haue seene this passage very often with the other arteriall pipe, but they serue onely for the Infant before it be borne, because his life and nourishment is much vnlike to that it is afterwards, and therefore after the birth the passage is altogether shut; & the pipe so dryed vp that a man would deny that euer any such thing was; the vse of this passage & pipe we haue at large described aboue, and thether do we transmit the Reader that is not satisfied concerning them.

The fourth opinion of *Vlmus*.

The last opinion of the preparation of the bloud, is that of *Vlmus* a *Physition of Poytou*, who set out a very eligant booke of the spleene. He is of opinion that the arteriall bloud is concocted, attenuated and prepared in the spleene, and thence conueied into the great artery and so to the left ventricle of the heart, where, by an admirable and mysticall worke of Nature it is mixed with the ayre already prepared by the Lungs. I must needs confesse

that

that the opinion of *Vlmus* pleaſed me wondrous well,both for the nouelty of the conceite, as for that he handled the matter with great ſubtilty of argument, and deepe diſcourſe; but becauſe he leaneth vpon vnſound foundations to eſtabliſh a new doctrine, which do ſhaddow the brightnes of the Art of Anatomy,it wil not be amiſſe to recal the principal points of it to the touch-ſtone in this place. A ſubtile diſputation.

Firſt of all, hee thinketh that the bloud cannot paſſe out of the right ventricle into the left by the fence or partition, becauſe (ſayth hee) if this way were not ſufficient in a tender Infant in whome the veſſelles are more laxe and the ſubſtance of the wall more rare and thinne,and wherein there is leſſe diſsipation or waſt of ſpirit; then ſurely it will much leſſe ſuffice in an older man: but this way is not ſufficient in the Infant, ſo that nature prouided another; to wit,two arteries,which are carried from the Nauel to his crural arteries.Therefore in a growne man it is neceſſary there ſhould be other more open paſſages.

An argument truely moſt ſubtile,but moſt falſe and ſtuffed with error: For in the Infant, the bloud doeth not ſweate through from the right ventricle to the left,becauſe there is no generation of vitall ſpirits in the ventricles of the heart;but the Infant draweth the mothers ſpirite by the vmbilicall arteries, which is diffuſed into all the ſtreames of the great artery. The Lungs are not nouriſhed with pure and thin bloud but with thicke,carried vnto them by the hollow veine; wherefore from that hollow vein to the venal arterie there is a cleare paſſage,and a conſpicuous pipe from the great artery to the arteriall veine,by whoſe interpoſition the veſſels of the heart in the Infant are vnited. Anſwere to *Vlmus*.

The opinion therefore of *Vlmus* is falſe, becauſe in the Infant there is no ſhop of the ſpirits, neither doth the orifice of the hollow veine powre out bloud into the right ventricle of the heart; for that,as *Galen* ſayth in the 15.Chapter of his 6.Booke, *de vſu partium*, the Lungs in an Infant are redde,denſe and immouable, and are nouriſhed with thick and groſſe bloud.

Secondly, the membranes placed in the orifice of the great artery (which hee calleth not well *three-forked*, for the values of the hollow veine and the venall artery one are three forked,the reſt are *ſemicircular*) he doth not imagine are made to that end that they ſhould prohibit bloud for going out of the great artery into the hart; becauſe while the Infant was in the wombe, they hindered not the arteriall bloud from entring into the left ventricle of the heart. But here *Vlmus* offendeth at the ſtone at which he ſtumbled before,for nothing floweth into the ventricles of the Infants heart by his foure orifices. Not bloud by the hollow veine,for what need is there of his attenuation,when the Infants Lungs are nouriſhed with thick bloud? Not ayre by the venall artery, for the Infant breatheth not in the womb. Not arteriall bloud by the *Aorta* or great artery,for this labor were vaine,becauſe in a moment it ſhould bee thruſt backe into the ſame *Aorta* againe: adde to this that there ſhould haue beene no neede of that arteriall canale or pipe going from the great artery to the arteriall veine,vnknowne to thee *Vlmus* as I ſee,and almoſt to all Anatomiſts. Nothing goeth into the Infants heart out of any of the veſſels.

Thirdly, whileſt *Vlmus* aſſenteth to *Botallus*, and faſhioneth to himſelfe a peculiar vſe of that hole or paſſage, he walloweth in the ſame puddle with him and deſerueth the ſame reproofe *Botallus* had. In confuting of *Columbus* he is moſt ſubtile, at length he bringeth to the birth his witty conceite which he trauelled with, and after many ſharpe throws and pinches is deliuered of it. To wit,that in the ſpleene the arteriall bloud is prepared,becauſe the ſpleene is made as it were of a woofe and web of veines and arteries inexplicably woouen together: that when it is ſo prepared it is ſucked away by the arteries and carried into the trunk of the great artery,and ſo into the left ventricle of the heart: but there be indeed many obſtacles which will hinder this ready paſſage if wee will but ſtay a while and follow the ſtreame a little. *Vlmus* opinio. How it cannot be true.

Firſt of all, in the orifice of the great artery there are three membranes ſhut without againſt it,ſo that by them the arteriall bloud cannot paſſe: This our very eies teach vs,and beſide our great *Dictator*, in his Booke *de Corde*, hath in direct wordes deliuered the ſame. *Vlmus* I know alſo will deny this vſe of the values,and yet I know alſo hee will not ſay that Nature formed them in vaine. I ſay then, that if they doe not altogether interclude or hinder the egreſſe and regreſſe of the bloud;yet as he himſelfe is conſtrayned to confeſſe,they break and ſtay the aboundant and violent influence of the ſame;which if they doe,then cannot the whole matter of the vitall ſpirits bee brought from the ſpleene by the great artery vnto the left ventricle of the heart; becauſe ſeeing the generation of the ſpirits muſt bee ſudden and aboundant, their matter alſo had neede to bee miniſtred with a full

ſtreame, and not drop or ſipe by degrees into the heart. Furthermore, in the ſtructure of the heart there is one point of Natures excellent worke-manſhip, that draweth by one veſſell, and expelleth by another. It draweth blood by the Hollow-veine, the ſame it expelleth by the Arteriall veine; it draweth aire hy the venall artery which it mingleth with the blood, and expelleth the vitall ſpirit into the great artery; but if by the great arterie it ſhould draw the matter of the ſpirites, and almoſt in the ſame moment ſhoulde expell the ſpirit into the ſame great artery againe, there would be a mixture of thoſe iuices, and in the arteries would there alſo be perpetually two contrary motions, one of the bloode, aſcending from the ſpleene to the heart, another of the arteriall bloode deſcending from the heart to the ſpleene, which as we admit may be ſometimes in criticall euacuations, & in notable Maiſter-priſes of Nature, ſo we deny it to be perpetuall, but the generation of ſpirits is perpetuall.

Obiection. *Vlmus* will obiect, that the venall Arterie leadeth aire vnto the heart, and ſhutteth alſo out into the Lungs ſmokie vapours, together with ſome portion of bloode: but we will an-

Anſwere. ſwere that there is not the like reaſon of aire and of blood. Aire by reaſon of his ſubtilitie and fineneſſe can paſſe through the blood and the coats, which blood cannot do.

Moreouer, if the Arteriall blood be prepared in the Spleene, and not in the right ventricle of the heart as *Galen* thought, why doth the Hollow veine open into the heart vvith

An argument ſo wide a mouth? Was it onely for nouriſhment of the Lungs? No verily, for the orifice of the Hollow veine is much larger then the orifice of the arteriall veine, as *Galen* ſaith (in his 3. booke and 15. chapter *De facultate Natural.*) was it for the nouriſhment of the heart? Nothing leſſe. For the heart hath a peculiar veine, called the Crowne veine by which it is nouriſhed; therefore that potent orifice of the Hollow veine at the right ventricle of the heart, was ordained to caſt in the ſeede of the ſpirites into the wombe of the heart, where

why the ſplene cannot prepare the blood for the heart. they are forced and ſent out into the little world of her bodye. Finally, from hence I gather, that the Spleene was not ordained for the preparation of the Vitall ſpirites, becauſe the Spleene is very ſubiect to obſtructions, not by reaſon of his veſſels which are very ample and large, nor by reaſon of his *Parenchyma* or fleſh which is rare and ſpongie, and therefore by reaſon of the fœculent and muddie humour conteined in it: but how ſhall it ſerue for the expurgation of the droſſe and the bloode and for the preparation alſo of the ſame

The concluſiō blood. Wee therefore conclude, that the bloode is prepared in the right Ventricle of the Heart and thence is deriued into the left by the holes and nooks of the partition wal.

QVEST. VII. *Whether the Matter and Quitture of thoſe that are called* Empyici *may be purged by the left Ventricle of the Heart and the Arteries, and how it is purged by the Vrine, by the Seidge and by Apoſtemation.*

Who be *Empyici.* THis Queſtion hath wrung the wittes of many Schollers a long time, notwithſtanding according to the meane modele of our wit, we will heere, if it may be vntie that knot. Wee call thoſe *Empyici* with *Hippocrates*, who haue an impoſture (as wee call it) or a bladder broken in the ſide or the Lungs, the matter of which is powred out into the cauity of the Cheſt, & there is kept and floweth vp and downe, ſo that with the impurity of it the Lungs are as it

This quitture may be purged 4. wayes. were laid in ſteepe.

This purulent matter, according to the doctrine of *Hipocrates* may be purged 4. waies; Vpward by the mouth, by the Vrine, by the Seidge and by Apoſtemation. The vpward

The eaſieſt way. exeretion is by a proper motion of the Cheſt, caſting that which is noiſome with a ſtrong contention out at the mouth. This is familiar to Nature, and the way which we alwayes deſire Nature ſhould take, for it is by places naturally commodious, & witneſſeth a ſtrong force and power of all the Faculties. And this is the proper *Criſis* of the *Empyici*, of thoſe that haue plurifies and inflamations of the Lunges: and this is the beſt and the ſafeſt way.

The other 3. wayes. But if Nature be inſufficient to mooue this way, either by reaſon of the thickneſſe of the matter that yeeldeth not to the concuſsion of the Cheſt, or becauſe of the Muſcles. Then Nature is ſo wiſe and prouident that it openeth another paſſage, findeth out ſome other way by which ſhe may eaſe her ſelfe both of the diſeaſe, and of the cauſe of it. Therefore,

By Vrine. oftentimes ſhe purgeth this purulent matter by the Vrine, ſometimes by Apoſtemation, ſometimes but rarely ſhe emptieth it by the ſeidge.

An inſtance. That it paſſeth away by the Vrine is prooued by daily experience, and euen now whilſt I am writing theſe things, Nature hath found this very way in an olde Gentleman a Lawyer, who hauing had a Pleuriſie, and no meanes of blood letting or almoſt any other of

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any moment, is beholding to Nature, who daily in great and notable abundance venteth this noisome humor by the Vrine. But beside experience, it may also be confirmed by the authority of very many, as well of ancients as of later writers. *Hippocrates* and *Galen* are very plentifull witnesses of it: we will onely quote the places in them, and thither referre the Readers for his better satisfaction. *Hippocrates lib.*1.*Epidem. sectione secunda*, twice in that section. *Lib.*3.*Epidem.sect.*3.*Galen lib.*6.*de locis affectis.Cap.*4.*Comment.ad Aphoris.*75.*sec.* 4. We may add to these if it were needfull, *Auicen*, *Paulus*, *Mesues*, and many others.

By Seidge. Thirdly, this matter is purged by the Seidge, but *Hippocrates* saith, *It is very daungerous, yea mortall. Galen* in his Booke *de Coacis*; *It is no wonder* (saith he) *that Quitture or purulent matter shhuld flow downe from the parts aboue the Midriffe into the belly, that is, into the guts.*

By Apostemation Fourthly, this matter is purged by Apostemation (Physitians call that *per abcessum*) either of the lower or vpper parts. *Hippocrates* saith in *Procholici*, *From a Peripneumonia or inflamation of the Lungs Apostumations do breede vnder the eares, or in the lower parts, and do there scoppurate, and those men are deliuered from the disease.* And againe *in Coacis*, *Those Apostemations that descend vnto the Thighes in such as are troubled with the Peripneumonia, are al of them profitable.*

Which way is best. Thus many wayes therefore are numbred by *Hippocrates*, by which the purulent matter of the Chest is by Nature euacuated, first by the mouth, secondly by the kidnies, thirdly by the gut and lastly by Apostemation or abcesse. The first is safest, and therfore chiefely to be desired, next that which is by the Vrine, for it bringeth least labour or trauel to the frame of Nature, that is, to the due disposition of the bodie: onely it is troublesome, because it is painefull, as being accompanied with a Strangurie, yet not that continuall, but catching as it were and by turnes. That which is by the guts is the worst of all, for it breaketh or dissolueth the Faculties of the stomacke, as well of Appetite as of Concoction, and of the guts also with his noysome stomacke, and beside by this acrimony and ill-quality of the matter, causeth an incureable bloody Flix. But that euacuation which is by apostemation is profitable, if so be it fall into the lower parts, both because it is far remoued from the first diseased part, and also because that kinde of excretion is as the Physitians sayes, The way of apostumation when good ἀξίως τῆς περιβολῆς, a conuenient kind of euacuation, and proportionable both to nature & to the disease. For a lawfull Apostemation ought neither to be ἡμίῤῥοπος nor ἀνάῤῥοπος, that is, neyther ought part of the matter flow to the place of Apostemation, but all; nor al take way vpward but downward, onely for to ascend is against the nature of the humor, and argueth alwaies a gadding quality therein.

By the womb. *Ariteus* in his booke *de Morbis Chronicis* addeth, that in women sometimes this purulent matter of the Chest commeth away by the womb. Thus we haue declared all the manners of Natures worke in the euacuation of noisome humors out of the cauity of the Chest, but by what wayes and passages Nature deriueth them as it belongeth to a higher contemplation, so will it be harder to know, and when it is knowne more profitable. The vpward expurgatiō by the sharp artery or wezon is manifest enough, for when the Chest is dilated the Lungs are blowne vp, & like a spunge sucketh vp the matter wherein they lie soked as it were in suds, & when the Chest is contracted the Lungs fall down, and so thrust out the purulent matter togither with the smoaky excrements of the heart into the sharpe arteries, and they by continuity of passage into the wezon, and so it passeth to the mouth, and by coughing is excluded. But by what waies it goeth to the kidnies & so to the bladder is greatly controuerted. *Erasistratus* would haue it go by the right ventricle of the heart, & so into the hollow vein, & there by the emulgent into the kidnies. *It is sucked* (saith he) *first by the rare & spongie flesh of the lungs, then by the arterial vein, which is appointed for the norishment of the Lunges, & thence is deriued into the right ventricle of the heart; out of it into the hollow veine, from thence into the emulgents, thence into the vreters, & so into the bladder.* But this opinion of *Erasistratus* cannot be true, because nothing passeth out of the arterial vein into the right ventricle by reason of the membranes which are shut outward, & nothing goeth out of the heart by the hollow vein because of the three-forked membranes which shut inward. *Mesues* was of opinion, that this expurgation of purulent matter is by the veines, somtimes to the concauous part of the Liuer, & so by the seidge away, sometimes to the gibbous or conuex, and so by the kidnies. *Fallopius* that oculate Anatomist, thinkes he found a neerer and more ready way, & so it describeth a small branch which runneth from the *Non-paril*, or *vena sine pari*, along by the ribs, and so pierceth the midriffe, & ioyneth it selfe with the fatty veine called *Adiposa* and the emulgent. This excretion of the *pus* or matter by the veines I do not altogither gainsay, yet I think it to bee a very vncouth way because their mouths opē not into the chest, neither are the veins stirred with any

How the matter of the *Empyici* is purged

How it commeth vnto the Kidneyes. *Erasistratus* his opinion.

Confuted.

Mesues opiniō

any motion whereby they might ſucke ſo thicke and fœculent a matter, and that it ſhould ſweate through their coates is a very difficult matter and hard to be beleeued. Some there are which dreame of certaine ſecret *meatus* or pores for this expurgation, becauſe when men are aliue all paſſages yea euen ſubſtances are open, and the body perſpicable both within and without.

Strange paſſages which nature findeth.

True it is, that the body is ſo open; for we know (as ſaith *Hippocrates* in his 2. Booke *de Epidemijs*, and the 55. Aphoriſ. ſect. 7.) *That nature maketh way for Apoſtumations, euen through the bones*; the dropſie water paſſeth out of the capacity of the *abdomen* into the guts and ſometimes into the wayes of the vrine, the vrine is tranſcolated through the fleſh of the kidneis, the ſeed through the ſubſtance of the teſticles, the flegmatick humors of the ioynts ſometimes are drawne into the guts, ſometimes in a ſlimy ſpittle they are auoided out of the mouth by vnctions of quick-ſiluer. All theſe things I ſay we admit, but why ſhould we ſeek ſuch inſenſible paſſages for this expurgation of purulent matter, when ther be many very patent and eaſie to be perceiued? But what are they? Let vs heare *Galen* chalking them out vnto vs, in his 4. chap. and 6. Book *de locis affectis*. *This queſtion* (ſaith he) *doth not a little trouble Eraſiſtratus followers, who thinke that there is nothing contained in the arteries but onely ſpirits; but to vs it is of no difficulty, becauſe we vnderſtand that the venall artery of the Lungs can leade ſo much of the purulent matter of an impoſtumation as it receiueth into the left ventricle of the heart, to be thence conueyed into the kidneyes by the great Artery.* His meaning therefore is, that the ſubſtance of the Lungs doth ſucke vp the *pus* or matter and deliuer it vnto the venall artery, that, vnto the left ventricle of the heart, the heart vnto the trunke of the great artery, and that, vnto the kidneyes and ſo to the bladder by the vreters. And before *Galens* time *Diocles* acknowledged the ſame way of expurgation.

Anſwere to the obiections

What the paſſages are.

Obiections.

But let vs heare now the exclamations of ſome new Writers againſt *Galen*. How may it be (ſay they) that ſo noyſome purulent and mattery a humour can be purged through the left ventricle of the heart, the ſhop and worke-houſe of the vitall ſpirits, and through the arteries the ſtore-houſes of the ſame ſpirits, without great danger vnto the patient? Shal not the ſpirits which of their owne nature are moſt pure, be infected and tainted in that medley? For if but a malignant vapor or poyſonous ayre do breathe from a bone, or any veſſell vp vnto the heart, ſtraight we are ouertaken with a fainting or ſwounding. Why therfore ſhall not an vnſauory and noyſome quitture or *pus* gotten into the very heart it ſelfe do at leaſt ſo much? But we know nature to be ſo wiſe and prouident that ſhee vſeth not to moue her excretions but by wayes that are ſafe and of auaile: now who will call the heart and the arteries places ſafe or conducible to lead away ſuch fœculencies? Theſe and ſuch like obiections they make who do not allow of the paſſages aſsigned by *Galen*. But they do not remember that it is one thing for a thing to be done critically, and another thing to be done ſymptomatically; one thing to be done by force & contention of Nature, another by the force and contumacy of the malady; one thing to be done by a faculty, another thing by a diſeaſe: and finally, one thing by a ſtrong and vigorous, another thing by a weake and feeble faculty.

Anſwere to them.

If this transfuſion of the purulent matter be criticall and the ſpirits ſtrong, then is this paſſage by the heart without any damage to the patient; for nature retaineth and preſerueth the ſpirits and auoydeth onely that which is hurtfull. But if the ſtrength be feeble, then doth the patient dye in the very expurgation; and if you cut him vp when hee is dead, you ſhall finde the left ventricle of the heart ful of purulent matter; which deceiueth many vnskilfull people, who cry out that his heart was apoſtumated.

A miſtaking of an apoſtumation of the heart.

Finally, beſide the authority of *Galen*, in his Commentary *In Coacas prænotiones*, and Anatomicall demonſtration, I will adde for confirmation of this poynt two Hiſtories. The firſt *Hollerius* reporteth where hee treateth of the heate of the vrine. A certeine woman (ſayth he) with intolerable torment did make a purulent water, after the fourth month ſhe dyed and was opened: there were found in her heart two ſtones, with many ſmall Apoſtumations, the Kidneyes and all the wayes of the vrine being ſound. Wherefore this purulent matter was purged by the great artery.

Two Hiſtories *Hollerius.*

Of the other Hiſtory *Laurentius*, one of our truſty guides in this trauell, is a witneſſe. An honeſt Citizen of *Mompelier* in *France* was ſicke or indiſpoſed with a hypochondriake melancholy for 3. yeares, and the diſeaſe was ſharpe: at length an acute Ague ouertooke him and he dyed, but a whole month before his death twice in a day lightly hee was troubled with a light ſwounding or fainting with ſome little heate of his vrine, and an incre-

Laurentius.

dible

dible deſire of making water, but after he had auoyded a thin, red and ſtinking vrine, hee came preſently againe to himſelfe.

After he was dead and opened, we found the whole cauity almoſt of his cheſt filled with that thinne, red and abhominably ſented humour, and the like wee found alſo the left ventricle of his heart to be full of, which, ſayth *Laurentius*, when I ſaw and wondred at, preſently the place in *Galen* before quoted came into my minde, and in the preſence of ſome maiſters in Chirurgery and many young ſtudients in phiſicke, I opened, that the cauſe of his frequent defections and vnconſtant ſtrangury was to bee referred to the transfuſion of the virulent matter through the left ventricle of the heart and the arteries; which my opinion they all applauded; becauſe the humour contayned in the cheſt and the vrine that hee auoyded in his defections or ſwounds were both of a colour, ſubſtance and ſauour. And thus much to redeeme *Galen* from the vniuſt impuration layd vppon him by ſome, otherwiſe not vnlearned, but in this not ſo conſiderate as I thinke they ought to haue been.

QVEST. VIII. *Of the Temperament, nouriſhment, Subſtance and Fleſh of the Heart.*

COncerning the Temperament of the heart, the Phyſicians are at great ſtrife among themſelues. *Auerrhoes* was of opinion, that the heart of his owne nature was cold, becauſe his greateſt part conſiſteth of ſuch things as are naturally cold, as immooouable fibres, foure great veſſelles which are ſpermaticall parts, and without bloud and cold; and that it is hot by accident onely, by reaſon of the hot bloud and ſpirits contained in it and his perpetuall motion. Of the temperament of the heart.

This opinion of *Auerrohes* his followers ſtrengthen with theſe reaſons. Firſt, becauſe the fleſh of the heart is thight and ſolide, and nouriſhed with ſolide, thicke and cold bloud. Secondly, becauſe at the Baſis of the heart which is his nobleſt part, there groweth a great quantity of fat, whoſe efficient cauſe (ſaith *Galen*) is cold. Laſtly, becauſe it is the ſtore-houſe of bloud; now bloud (ſaith *Hippocrates* in his Booke *de Corde*,) *is naturally cold, for as ſoone as it is out of the veines it caketh.* But to the firſt argument we anſwere, that the fibres and the veſſels are not the chiefe parts of the heart, but the fleſh: and therefore *Ariſtotle* and *Galen* call it a fleſhy *viſcus* or bowell. To the ſecond, that the fat groweth not in the ventricles, nor about the fleſh of the heart, but onely about his Membrane which in reſpect of his fleſh is but a cold part: beſide Natures finall cauſe, that was to keepe the heart from torrifying, ouercame all the reſt, which thing in nature is not vnuſuall. To the third we anſwere, that there are two ſorts of blood, one venall and another arteriall; the veniall indeed is leſſe hot but the arteriall bloud is exceeding hot. Now the hart is the ſhop or worke-houſe of arteriall not of venall bloud.

Auerrhoes that the heart is cold. The 1. reaſon The ſecond. The third. Anſwere to the firſt. To the ſecond To the third.

We conclude therefore that the heart is not onely hot, but of all the bowels the hotteſt, which we are able to prooue by authorities, reaſons, and experience. *Hippocrates de principijs* ſaith, *There is much heate in the heart, as being of all members the hotteſt.* *Galen* in the laſt chapter of his firſt booke *de temperamentis.* *The bloud receiueth his heate from the heart, for that of all the bowels is by nature the hotteſt.* The reaſon is, The hart is the fountaine of heat & of the Nectar of life: it ingendereth the arteriall blood, the venall it attenuateth for the Lungs; heere the vitall ſpirits the hotteſt of all others are made. Finally, heere is the hearth & the fire wherby the natural heate of al the parts is refreſhed. Experience alſo. For if you put your finger into the hart of a beaſt ſuddenly opened, the heat of it wil euen burn as *Galen* ſaith in his firſt booke *de ſemine*, and experience proueth. Againe, the fleſh of the heart is the moſt ſolid of all fleſh, becauſe it is ingendered of moſt hot bloud, made denſe and thicke by the parching power of an exceeding great heate. But ſome will ſay that the ſpirits are hotter then the heart: I anſwere, it is true that in the ſpirits there is a greater heat, but in the heart there is more heate, more ſharpe and which heateth more, becauſe of the denſity of his ſubſtance; ſo fire in ſtraw or ſtubble though it be a flame burneth but lightly, for you may draw your hand through it without any great offence; but hot glowing yron although it haue not the ſame degree of heate that the flame hath, yet it burneth more ſtrongly and cannot be touched without danger. But it may be demanded, if the ſpirits be hotter then the heart and are bred in the heart, whence haue they that greater heat? I anſwere, The heart conſiſteth of three parts as it were or ſubſtances; a ſpiritual, a moyſt and a ſolid. The ſpirits are ingendered of the ſpirituall and hotteſt part of the heart, and are hotter indeed then the whole heart, but not hotter then that part that ingendereth the ſpirits.

That the hart is hot. Authorities. Reaſons. Experience. How the ſpirits are hotter then the heart by which they are made. Compariſon. Whence the ſpirits haue their heate that is hotter then the hart is. Three ſubſtãces of the heart.

rits. That this may be, *Galen* giueth an inſtance in milke: milke in his whole ſubſtance is either cold or temperate, but his fatty and buttery part is hotter then the whole body of the milke; ſo the heart is hot in his whole ſubſtance, but the ſpirituall part of the heart is hotter then the whole heart, and from that part haue the ſpirits their intenſe heat: & thus much of the actiue qualities of the heart. Now for the paſsiue there is as great diſſention. *Auicen de Temperamentis*, and *Galen* in his ſecond Booke *de Temper. Cap.* 3. and 12. and in his 3. Booke *de Aliment. facultatibus* ſay it is dry, and his fleſh hard and ſolid; now it is a ſure rule *That whatſoeuer is hard to feele too in a liuing body, that alſo is dry.* On the other ſide *Auerrhoes* will haue it moyſt, becauſe life conſiſteth in heate and moyſture, but the heart is the beginning of life and the ſhop of moyſture. *Galen* in the laſt Chapter of his firſt Booke *de Temperamentis*, calleth it a Bloudy Bowel, therefore moyſt; and in the ſame Chapter, *It is a little leſſe dry then the skinne*, therefore moyſter then the skinne. I anſwere, it is true that the heart is moyſter to feele too then the skinne. But *Galen* when hee ſayeth it is drie, compareth it not to the skinne but to the other parts, for ſo his words are. *The fleſh of the heart is ſo much dryer then the fleſh of the ſpleen or kidneyes, as it is harder*: And ſo much of the Temperament of the heart.

Whether the hart be moyſt or dry.

An axiome.

Reſolution.

How the hart is nouriſhed.

Concerning his nouriſhment, *Galen* in his firſt Booke *de vſu partium*, and the 7. *de Adminiſt. Anatomicis*, ſayeth it is nouriſhed with venall and thicke bloud; many of the later writers ſay it is nouriſhed with the thin bloud contayned in his ventricles. On *Galens* ſide, that is on the trueths, are theſe reaſons. It is a Catholicke principle, *Euery thing is preſerued and refreſhed with his like*. The fleſh of the heart is hard, thicke and ſolid, ſuch therfore muſt be his nouriſhment: beſide there is a notable veine called *Coronaria* or the Crowne-veine, which compaſſeth a round the Baſis of the heart and ſendeth foorth branches into all his ſubſtance; but Nature vſeth not to doe any thing raſhly or in vaine, it ſerueth therefore for his nouriſhment: beſide occular inſpection prooueth it which no reaſon can conuince.

An axiome.

An argument from ocular inſpection.

The braunches of the coronarie veine are more and more conſpicuous on the left ſide of the heart then on the right, becauſe the thicker part wanteth the more nouriſhment. But the aduerſaries ſay that the outward part is onely nouriſhed with this veine, the inward with the bloud contayned in the ventricles: for ſay they, this veine is too little to nouriſh the whole heart being a very hot member and in perpetuall motion; beſide the veine looſeth it ſelfe in the *ſuperficies* of the heart and paſſeth not into the ventricles. But for the narrownes of the veine I cannot perceiue it is ſo ſmall as they talke of it; and for this motion it is true, yet there are many things that temper it, on the outſide it is couered almoſt with fat and compaſſed with a watery humour, and within it hath aboundant moyſture whereby though it be not nouriſhed yet is it watered and kept from drying and flaming; as boyling hot water keeps a veſſell on the fire from burning. And whereas they ſay the branches of the coronary veine paſſe not into the ventricles; I anſwere, that neither are the veſſelles diſperſed into the inner ſubſtance of the muſcles and the bones. *Hippocrates* ſayeth *That fleſh draweth from the next veſſels*. If you would faine reconcile the newe writers to *Galen*, you may ſay. That haply the inward parts of the heart are nouriſhed with the bloud contayned in the ventricles but not yet attenuated, for why ſhould the inward parts be nouriſhed with rarified bloud and the outward with craſſe and thicke; ſeeing the nature of the inward fleſh and outward is all one? and ſomuch of the nouriſhment of the heart.

Arguments for the other ſide.

Anſwered.

A reconciliation.

Nowe for the ſubſtance and fleſh of it, ſome ſay it is muſculous, but that we haue anſwered before in the deſcription; briefly thus. *Hippocrates* in his Booke *de Corde* calleth it a ſtrong muſcle: againe it is moued by a locall motion and ſo are none of the other bowels, as the Liuer, the Spleene, the Kidneyes, &c. but all muſcles are ſo moued. Moreouer, the fleſh of the bowels is ſimple and ſimilar, but the fleſh of the heart not ſo but wouen with threds and fibres like that of the muſcles, therefore it is a muſcle. *Galen* on the contrary will haue it no muſcle, for that muſcles haue ſimple fibres but the heart manifold, the muſcles haue but one and that a ſimple motion, for they bow or ſtreatch forth, lift vp or pull downe; but the heart hath diuers yea contrary motions: and this is a very powerfull argument which yet ſome ſeeke to ouerthow: becauſe ſay they there be many muſcles which haue diuers kinds of fibres, and alſo diuers yea and contrary motions; as the *Pectorall* muſcle which hath diuers fibres: and moueth the arme not vpward and downward onely but forward: alſo and the muſcle called *Trapeſius* which moueth the ſhoulder blade not only vpward and downward but backward alſo; and therefore the variety of his fibres and the diuerſity of his mo-

Of the ſubſtance of the heart.

Whether it be a muſcle,

That it is,

That it is not.

Anſwere of ſome to *Galens* argument.

tions

tions do not exempt him from the number of muſcles.

I anſwere for *Galen*. Thoſe two Muſcles aboue named haue indeed diuers motions but not from the ſame part; but from diuers parts of the muſcles; for they haue diuers originals or beginnings. The *Trapeſius* ariſeth from the *back-part* or nowle of the head & from the rack-bones of the backe; by the former part it moueth vpward, and downeward by the latter. The *pectorall* alſo hath diuers beginnings, for it ariſeth from the *Throte* and from the whole breaſt-bone; wherefore theſe muſcles doe not pull downe with the ſame part wherewith they lift vp, but the heart is dilated and contracted in the ſame part; there is not therefore a like reaſon of their motions. The like may be ſaid of their fibres; for the fibres of thoſe aboue-named muſcles though they be of more kinds thē one yet are they diſtinct; the fibres of the heart are wouen together and confounded that no art or induſtry wil part them. The fibres of the muſcles are diuers in their diuers parts, but thoſe of the heart are all in euery ſmall part of the heart.

Anſwere for *Galen*.

Moreouer, the taſte of the heart and of the muſcles is not one ſaith *Galen* in the 8. chapter of his 7. booke *de Adminiſtrat Anatom*. *Auicen* ſaith the muſcles are weary the heart neuer: yet this ſeemeth to be no ſound reaſon, becauſe the midriffe which is a very ſtrong muſcle mooueth perpetually: but *Auicen* hath another reaſon for *Galens* opinion of more force which is this. The heart is no muſcle becauſe his motion is not voluntary, for we can neither forſlow nor haſten, neither ſtay nor ſtirre vp his motion as we may the motion of the midriffe and of all the other muſcles. We conclude therefore with *Galen* that the heart is no muſcle, but either an affuſion of bloud which *Eraſiſtratus* called *parenchyma*; or ſome peculiar fleſh. How *Hippocrates* is to be vnderſtood wee haue ſaid before, to wit, abuſiuely; it is muſculous becauſe it is red & fibrous, but not a muſcle. But it will be obiected it is moued with locall motions, therefore it is a muſcle.

Auicen for *Galen* one weake argument.

Another ſtronger.

The concluſion with *Galen*.

Anſwere to *Hippocrates* authority.

I anſwere, that by the ſame reaſon ſhould the wombe be a muſcle, for we haue ſhewed how that is moued euen locally ſometimes, as when it cloſeth in conception, or is dilated in the birth: and the guts haue a locall motion called *motus periſtalticus* which no man will ſay is a voluntary motion or that therefore they are muſcles.

To the firſt reaſon.

To the other argument we ſay, that the fleſh of the heart though it bee fibrous yet it is ſimple, becauſe the fibres are of the ſame ſubſtance with the fleſh of it as the fibres of the ſtomacke, the wombe and the guts; but the fibres of the muſcles are particles of Nerues and Tendons much vnlike their fleſh: and this indeed is *Galens* anſwere in his 2. booke *de temperamentis*; yet we affirme that the fibres of the heart are ſtronger and harder then the reſt of his fleſh, which maketh it ſtronge and better able to indure his perpetuall labour.

To the ſecond.

But why is the fleſh of the heart more fibrous then that of the Liuer or kidneyes. *Galen* anſweres, *The fibres of the heart are made for neceſſary vſes of traction retention and expulſion, by the right it draweth in the Diaſtole or dilatation; by the oblique it retaineth, and by the tranſuerſe it expelleth in the* Syſtole *or Contraction.*

Why the fleſh of the hart is fibrous

QVEST. IX. *Whether the heart will beare an apoſtumation, ſolution of continuity or any grieuous diſeaſe.*

THE laſt quæſtion concerning the heart ſhalbe whether it will beare any notable diſeaſe or no. *Hippocrates* ſaith, (in his booke *de morbis.*) *The heart is ſo ſo id and denſe that it is not offended with any humour*, and therefore it cannot be tainted with any diſeaſe. *Ariſtotle. The heart can beare no heauy or greeuous diſeaſe becauſe it is the originall of life. Aphrodiſæus. In the heart can no diſeaſe conſiſt, for the patient will dye before the diſeaſe appeare. Paulus. Any diſeaſe of the heart bringeth death head-long vpon a man. Pliny. Onely this of all the bowels is not wearied with diſeaſes, neyther indureth it the greeuous puniſhments of this life; and if it chance to bee offended preſent death inſueth.* Yet how repugnant this is to experience many Hiſtories doe beare witneſſe. *Galen* (in his 2. Booke *de placitis*) reporteth that a ſacrificed Beaſt did walke after his heart was out, and in his 7. Booke *de Adminiſtra. Anatom.* he maketh mention of one *Marullus* the ſonne of a maker of Enterludes, who liued after his heart was laide bare euen from the purſſe or *pericardium*, and (in his 4. booke *de locis affectus*) if a man be wounded in the heart and the wound pierce not into the ventricles but ſtay in the fleſh, he may liue a day and a night. *Beneuenius* writeth that he hath ſeene many Apoſtemations in the heart. We told you a ſtory euen now out of *Hollerius* of a woman who had two ſtones and many Apoſtemations found in her heart.

Authorities that the heart will not beare a diſeaſe. *Hippocrates. Ariſtotle. Aphrodiſæus. Paulus Aegineta. Pliny.*

Manifold Hiſtories prouing the contrary.

Matthias

Mathias Cornax Physitian to the Emperor *Maximilian* saith, that he dissected a Booksel-ler, and found his heart more then halfe rotted away. *Thomas a Veiga* writeth, that there was a red Deere found, in whose heart was sticking an olde peece of an Arrow wherewith he had beene long before wounded in hunting. But you shall reconcile these together, if you say the heart will beare all afflictions, but not long; or that it is subiect to all kinds of diseases, but will beare none greeuous. For example, the heart will suffer all kindes of distemper, but if any distemper be immoderate or notable the party presently dies, so sayeth *Galen* in his fift Booke *de locis affectis*, *Death followes the immoderate distemper of the Heart*; When *Galen* saith, in the fifte Chapter of his first Booke *De Locis Affectis*. That the heart will beare no Apostemations, hee vnderstandeth such an Apostemation as comes by the permutation of an inflamation. For the Creature will die before the in-flamation will suppurate or grow to quitture. Say that the Apostemations found by *Beni-uenius*, *Hollerius* and *Mathew Cornace* were Flegmaticke; or say, that rare things do not be-long to Art; or with *Auerrhoes*; as in Nature so in diseases wee oftentimes finde Monsters. That a creature can walke and cry when his heart is out I beleeue well so long as the spi-rits last in his body which it receiued from the heart, when they faile hee presently dieth. *Andreas Laurentius* maketh mention of a strange accident which happened in the Court of *France*. *Guichardine* a Noble Knight and Ambassador for the Duke of *Florence* beeing in good health and walking with other Noble-men, and talking not seriously but at ran-don, presently fell stone dead neuer breathing and his pulse neuer moouing. Manie tolde the King, some saide he was dead, some that hee was but falne into an Apoplexie or a Fal-ling sickenesse and that there was hope of his recouery; The King (saith *Laurentius*) com-manded me to take care of him; when I came, I found the man starke dead, and auouched that the fault was not in his braine but in his heart. The next day his bodye was opened, and we found his heart so swelled that it tooke vp almost all his Chest; when wee opened the Ventricles, there yssued out three or foure pound of blood, and the orifice of the great Veine was broken, and all the forked Membranes torne, but the Orifice of the great Artery was so dilated that a man might haue thrust in his arme So that I imagine, that all the Flood-gates being loosened, so great a quantity of bloode yssued into the Ventricles that there was no roome for the dilatation or contraction, whereupon hee fell suddenlie dead; yet is it a great wonder how without any outward cause of a stroke, or fall, or voci-feration, or anger, so great a vessell should be broken. It may be he was poisoned, for the Italians they say are wondrous cunning in that Art, & in the Contention of Nature that dilaceration hapned.

How these are to be recon-ciled.

Galen inter-preted.

Answeres to the examples

A strange sto ry of a *Floren-tine* Ambassa-dor in the Court of France.

QVEST. X. *Of the nature of Respiration, and what are the Causes of it.*

A briefe enu-meration of the difficul-ties about the motion of the heart.

AND thus much of the proper motion of the Heart, what causes it hath, what manner motion it is, what power or faculty mooueth the Arte-ries, when and as the heart is mooued; or after and otherwise: Howe and where the vitall spirites are generated and their immediate matter prepared, what is the temperament of the heart, how it is nourished, what his structure is & how many the parts are of his substãce with their vse and functions: Finally, howe able to beare and endure affectes and diseases. The re-solution of which questions, though they do not properly pertaine vnto Anatomy all of them, yet do they so depend one vpon another as it seemeth necessary that he that would know one should also know all; notwithstanding in our treating of them we haue verie of-ten restrained our Discourse and conteyned it within such limites as are not farre distant from Dissection it selfe.

Of Spiration.

It remaineth now, that we should a little stand vpon another motion in our bodies and the Instrument thereof which Nature hath ordained to be seruiceable to this motion of the heart, and that is Spiration or breathing. For the Heart being exceeding hot and therfore a part of great expence needed a continuall supply of nourishment for the spirites, and of ventilation for himselfe. For *Hippocrates* saith in his Booke *De Natura pueri*, *Calidũ omne frigido moderato Nutritur & fouetur*? That which is hot is nourished and cherished by that which is moderately colde: which sentence *Galen* in his Booke *de vsu Respirationis* thus ele-gantly expoundeth; Euen as (saith he) a flame shut vp in a straite roome and not ventilated with the aer burnes dimmer and dimmer till it be extinguished, so our naturall heate if it want cold to temper it growes faint and wasteth away to vtter confusion. For it is like a flame mooued both waies, vpward downward, inward and outward; vpper and outward,

Why neces-sary.

because

becauſe it is light as being of a fiery and aery nature; downward and inward in reſpect of his nouriſhment; either of theſe motions if they he hindred, the heate either decayeth or is extinguiſhed; it decayeth for want of nouriſhment becauſe it cannot be mooued down ward and inward. It is ſtrangled and extinguiſhed when it cannot be mooued vpward and outward and ſo refrigerated.

Wherefore, the ſpiration or breathing of colde is verie neceſſary for the preſeruation of naturall heate; but what ſhall this cold be? Surely either aer or water: aer is more neceſſary in perfect and bloody creatures, firſt becauſe it ſooner followeth the diſtention of the breſt and ſo the dilatation of the Lunges, and filleth all that is dilated to keepe out vacuity; ſecondly it cooleth ſooner, as better diſtributing his partes into euery ſecret corner of the heart: finally, it is better expirated or breathed out then water, though it be not more eaſily drawne in. Aer then is the beſt cooler for the heart, and that muſt be brought vnto it by breathing: now this ſpiration or breathing is double, inſenſible and ſenſible; Inſenſible ſpiration *Hippocrates* and *Galen* cal properly διαπνοὴν, and the Latins *Perſpiration* & *Tranſpiration*. The other and ſenſible breathing is called ἀναπνοὴ, that is, *Reſpiration*. Tranſpiration is by the ſecret pores of the skin, Reſpiration by the mouth and the noſe. Thoſe creatures whoſe heate is weake and faint do liue onely by Reſpiration, ſo all that are without blood or which we cal *Inſecta* of certaine diuiſions they haue about their necks or bellies; ſo the infant in the womb tranſpireth onely but doth not reſpire; and many women in fits of the Mother (the naturall heate of their hearts being diſſolued by a poiſonous breth ariſing from putrified ſeede) do liue a while in trances onely by Tranſpiration. But thoſe creatures whoſe heate is neerer to the nature of flame, by tranſpiration onely cannot bee tempered. Wherefore ſuch heate needeth a farther helpe to waſte more aer vnto it, and that is done onely by reſpiration.

Whether aer or water is fitteſt to cool the heart.

Tranſpiration & Reſpiratiõ.

Fittes of the Mother.

This Reſpiration therefore hath two parts, Inſpiration and Expiration; Inſpiration is the drawing in of the aer, Expiration the breathing it out. Inſpiration is like the *Dyaſtole* of the heart, Expiration like the *Syſtole*.

The partes of Reſpiration.

This Reſpiration whether it be Naturall or Animal hath troubled the heads of Schollers a great while, and would alſo now trouble ours if we ſhold muſter together all the Reaſons which are brought on both ſides; yet becauſe the queſtion is worthy the deciſion wee will breefely as we can reſolue it with your patience. The arguments to prooue it not to bee Animall or voluntary are. Firſt becauſe voluntary actions are from election: but men aſleepe (when yet there is reſpiration) haue no election, no will, becauſe ſleepe is a reſt or ceſſation of all Animall actions. Hence it is that *Galen* calleth the *Caros* a ſleepie diſeaſe *Puiuationem Animalitatis*, a priuation of al the animal Faculties; yet in that diſeaſe the Reſpiration is free: as likewiſe in the Apoplexie which is a reſolution or palſie of the whole body. Now where is no ſenſe remaining, can there then remaine any voluntary motion? yet we ſee Reſpiration remaineth.

Whether Naturall or Animal.

Not Animall.

The Reaſons.

Againe, to be voluntary and perpetual are contraries; for voluntarie actions do al breed wearineſſe, but Reſpiration breeds not wearineſſe in the motion, but if the motion be any whit checked or ſtayed, that ſtay or checke breeds wearineſſe: Finally when the Reſpiration is vitiated we apply remedies vnto the region of the heart not vnto the braine, which is the originall of voluntary motion. On the contrary, the great argument to prooue it to be voluntary is, that we can breath when we will, and when we will we can ſtay our breath: ſo as many haue thus voluntarily ended their dayes, I meane by ſtaying their owne breath. *Galen* in his ſecond Booke de *Motu Muſculorum* telleth of a Barbarian ſeruant, who beeing throughly angred purpoſed to lay violent hands vpon himſelfe, hee threw himſelfe therefore vpon the ground, and held his breath a long time remaining vnmooued, at length turning himſelfe a little he breathed out his life.

That it is Animall.

Hiſtories.

C. Licinius Macer a Pretorian Citizen of Rome, being accuſed for oppreſion by exactions, whilſt the Iudges were giuing ſentence ſhut vp his owne mouth, and couering it with his Handkerchiefe reteyned his breath till he fell downe dead.

Coma the brother of one *Maximus* a Captaine of Out-lawes, when hee was asked concerning the ſtrength and enterpriſes of the Fugitiues, gathered his ſtrength together, couered his head, and falling vpon his knees held his breath till he dyed euen in the handes of thoſe that guarded him and before the face of the Iudges.

Cato Vticenſis, when his ſonne had taken away his ſword, he perſwaded his Seruants to giue it him againe, ſaying he would keepe it for his defence, not to murther himſelfe with.

How to cure yawnings & the hiccock.

For sayeth hee, *If I listed to die, I could easily hold my breath to serue that turne*: Besides *Hippocrates* sayth in his third Section of the second Booke *Epidemion*, that the cure of continuall yawning which Physitions cal *oscitation*, is long breathing: & *Aristophanes* in *Plato* his *Symposio*, being troubled with a hiccock, intreated *Eriximachus* the Physition to tell out his tale for him, *That wil I saith he, & in the meane time hold your breath some good while & your hiccock wil cease, and then you shall take my turne as I haue taken yours.* We may then reteyne our breath when and how long we will and therfore it is a voluntary action. For the instruments whereby wee breath are all Animall, as the *intercostall* muscles, the midriffe which is also a muscle, and the nerues. Finally, if the braine bee offended as in a phrensie, then is the Respiration offended.

A reconciliation of 2. aduerse opinions.

Wee see here two opposite opinions, both which wee cannot maintaine vnlesse they will either of them remit somewhat and yeeld a little either to other, and then it will not be hard to reconcile them after this manner. Some actions are purely and simply Naturall, as Concoction, Nutrition &c. Some partly voluntary, as speech and walking. Some mixt, that is partly Naturall partly Animall, as the auoyding of water and excrements, as *Galen* sayth in the fourth Chapter of his 6. Booke *de locis affect*; and in the sixt Chapter of his second Booke *de motu musculorum* he likeneth Respiration to these. Respiration therefore is a mixt action, partly Natural and that in respect of the final cause and of necessity, partly Animall in respect of the instruments of it, the muscles.

Respiration a mixt action.

3. instances.

Those that are strangled do not breath because they cannot Animally; the nerues and muscles being intercepted with the rope. *Hysterical* woemen that are troubled with the *mother* do not breath, because they cannot Naturally: for there is no vse of respiration, nor no necessity vrging it although the instruments bee at liberty; and Nature hath here very wisely ordayned that although this action were absolutely necessary and so naturall for the preseruation of life; yet there should also be in it some commaund of the will, because it is often very profitable to stay the breath and often to thrust it out with extraordinarie violence.

Why it was necessary that respiration should be partly voluntary.

If wee be to giue very diligent eare to any thing, if to passe through any vnsauoury or noysome places, if we fall or be throwne into the water, it is very necessary that we should bee able to conteyne our breath: on the contrary, to blow vp any thing, to winde a horne or sound a trũpet, to blow the fire or such like; it is very profitable that we should be able to breath with extraordinary violence. Now in a word we will satisfie the arguments on both sides; and to the first in the first place.

They say that men Respire when they sleep, but in sleepe there is no vse of election or will. I answere there is a double will, as *Scaliger* sayeth, *One from election proper to men and men awake, the other from instinct and this is in men a sleepe and in bruite beasts.* The motion of respiration when we sleepe is by instinct, neither are all the Animall faculties idle in sleepe, or extinguished in those diseases before named; but in sleep they are *remitted* as *Galen* sayth not *intermitted*; for euen the muscles haue a motion which we call *Tonicum motum A rigid motion*, especially the two sphincter muscles, and in the diseases they are depraued.

Wil is double

Motus Tonicus

The reason why we are not wearied with continuall respiration, is because there is continual vse and necessity of it, although it cannot be denied that euen respiration being constrayned wearieth the creature much.

On the contrary, they that affirme this respiration to bee meerely voluntary, alleadge that we are able to stay it when we will and to moue it when wee will; to which I answere. That is properly and absolutely a voluntary action which may bee stayed at our pleasure when it is doing, and againe done when it is stayed; but respiration is no such action: for if the Respiration be altogether stayed, as in those whose histories are aboue mentioned, then is the creatures life extinguished and the respiration cannot againe bee mooued. And for the two other arguments that respiration is by Animall instruments, & that in a phrensie which is a disease of the brayne, the respiration is vitiated. I answere, that they proue indeed that in respiration there is somewhat voluntary, but they doe not proue that there is nothing naturall. We therefore do determine that Respiration is a mixt action, and to it do concurre both principles ioyned together the Brayn and the Heart, the Animall and the Naturall faculties.

The determination.

To conclude this Chapter and discourse of Respiration: The pulse and respiration we see are two distinct motions, yet so neare of kinne as men doe not ordinarily obserue the diffe-

differences betweene them: wee will therefore in a word tell you wherein they differ and wherein they agree.

They agree in that that they both ſerue one faculty that is the Vitall; for they were both ordained onely for the heart which is the ſeate of the vitall faculty. Moreouer, they haue both one finall cauſe a threefould neceſsity; of nutrition, temperation and expurgation: nouriſhment of the ſpirits, tempering of the heate and purging of ſmoky vapours. Thirdly, they agree in the condition of their motions, for both of them conſiſt of a *Syſtole* and a *Diaſtole*, and a double *reſt* betweene them: but in theſe things they differ. That the pulſe is a Naturall motion, continuall not interrupted, and without all power of the will. Reſpiration is free, and ceaſeth ſome whiles at our pleaſure; the efficient cauſe of the pulſe is only Nature, of Reſpiration Nature and the Soule togéther; the inſtruments of the pulſe are the heart and the arteries, of Reſpiration the muſcles: the pulſe is from the heart, Reſpiration not from the heart but for the heart. Finally, the heart beateth fiue times for one motion of Reſpiration.

Whether is more noble and neceſſary the pulſe or reſpiration.

Laſtly, whether is the pulſe or Reſpiration more neceſſary or more noble? More noble ſurely is the pulſe, becauſe his inſtrument the heart is more noble, his effect the vitall ſpirit is more noble then the ayre; and the end is better then that which ſerueth for the end: but Reſpiration was made for the preſeruation of the pulſe: but nowe for their neceſsity there needeth a diſtinction. There is one pulſe of the heart and another of the arteries; the pulſe of the heart is more neceſſary for life then Reſpirution, but the particular pulſation of the arteries is leſſe neceſſary then Reſpiration; for though the arteries bee bound or intercepted the creature dyeth not preſently, but if the Reſpiration be ſtopped hee is preſently extinguiſhed.

QVEST. XI. *Of the Temperament and motion of the Lungs.*

Of what temper the lungs are.

That they are cold.

Reaſons.

Concerning the Temperament of the Lungs, there is queſtion among the Maſters of our Art. Some hold them in the actiue qualities to bee cold, others to be hot. Thoſe that would haue them cold giue theſe reaſons for their aſſertion.

First, becauſe their whole frame and ſtructure conſiſteth of ſpermaticall that is cold parts: theſe are, the griſtly artery, the arteriall veine, and the venall artery.

Secondly, becauſe they are made to refrigerate the heart, wherefore they are called the *Fanne of the heart.*

Thirdly, becauſe they are ſubiect to colde diſeaſes, as obſtructions, ſhortnes of winde, difficulty of breathing, and knottines called *Tubercula.*

Fourthly, becauſe they abound with flegmaticke and cold humors, which is diſcerned by that we cough vp.

Authority.

Laſtly, they alleadge an authoritie and a reaſon out of *Hippocrates*, the authority, for that he ſayth, *The Lungs are of their owne nature cold, and are farther cooled by inſpiration. Hippocrates* ground out of which they draw this argument is where hee ſayeth in his Booke *de Alimentis*, *The Lungs do draw a nouriſhment contrary to their body, whereas al other parts draw that which is like to them.* From whence they reaſon thus: The Lungs draw vnto themſelues blood attenuated in the right ventricle of the heart and are therewith nouriſhed. That bloud being very hot, their ſubſtance (if *Hippocrates* ſayd true, who is ſayde neuer to haue deceiued any man, nor neuer to haue beene deceiued himſelfe) muſt needes bee cold. But theſe arguments may thus bee anſwered.

A reaſon drawne from *Hippocrates.*

Anſwere to the argu. ments.

To the firſt, the veſſels are not the ſubſtance of the Lungs but the fleſh; which is made of a hot and frothy bloud.

To the ſecond, that they refrigerate and coole the heart not by their owne Temperament, but becauſe they drawe and containe outward ayre, which is alwaies colder then the heart though it be neuer ſo foultry hot.

To the 3. that their veſſels becauſe they are many and diuerſly implicated are ſubiect to obſtructiõs, but their fleſh which is their true ſubſtãce is ſubiect to inflamations & hot affects.

Whence the phlegme commeth that we cough vp.

How it becommeth white.

To the fourth, that the aboundance of flegme which we cough vp, is not generated by the natiue temper of the Lungs but falleth continually from the head which is the receptacle of cold excrements into the Lungs, ſo ſaith *Hippocrates*, *Many Catarrhes or Rheumes fall into the vpper venter*, that is the Cheſt. The lower part alſo as the ſtomack and the *hypochondria* do ſend vp plentiful vapors which the Lungs with this continuall motion do mixe with the foreſaid humor & thence commeth the whitnes. And as for *Hippocrates* authority

it may bee answered that hee compareth the temper of the Lungs with the temper of the heart and then indeed they are cold, as also the aer of a hot-house is cold in respect of the heart.

Hippocrates expounded & retorted.

In the other place we say that *Hippocrates* speaketh of the aer inspirated or breathed in, not of bloud; and so that place proueth that the Lungs are hot rather then cold, because they draw aer which is cold and contrary to their body which is hot. But the truth is, that the contrariety he speaketh of in that place is rather a contrariety of motion; as if hee should say, other parts draw a nourishment like vnto themselues frō an inward store-house which is the Liuer into the very vtmost parts of the body; but contrariwise the Lungs draw the nourishment of the spirits, that is, the aer by the outward parts, that is, the nose and the mouth into the inward, that is, the heart. Although I am not ignorant that *Galen* interpreteth those words otherwise which shall not be necessary to make mention of in this place.

That the lungs are hot. 3. arguments.

It seemeth therefore that the Lungs are not cold; which yet will better appeare if wee can proue them to be hot. Three arguments we will be contented with; one from their substance, another from their nourishment, and a third from their vse. Their substance is fleshy soft & spongy, made as it were of the froth that ariseth of the hot bloud in the boyling; therefore not cold. Againe, they are nourished with thin bloud heated and attenuated in the right ventricle of the heart, which seemeth to haue beene made especially for the Lungs sake. Lastly, their vse is to prepare aer for the generation of the vitall, that is, the hottest spirit; they must therefore be hot. Thus Physitions reason on either side. I will onely heere put a doubt, reseruing the determination to another place.

A notable doubt put.

The Rheume falleth out of the head, part into the Lungs and part into the stomacke; Nature in both places worketh vpon it. The stomacke boyleth it againe, attenuateth it if it be thick, and of some part of it maketh good bloud; the rest it auoydeth into the guttes where another vse is made of it; and if the heate of the stomacke be languide and weake so that it cannot sufficiently mitigate it, we then helpe Nature.

Why the Rheume must be thickened before it bee coughed vp. Whence dry coughes cōe.

The Lungs quite contrary do thicken that part which falleth into them and that necessarily, for else it could neuer he auoyded; for it must be a solid body that the aer must lift vp before it in our coughing, because there is no passage for it downward appointed by Nature; and therefore it is, that thinne and subtle Rheume maketh a dry cough because the aer is not able to intercept it, but it trickleth downe the sides of the weazon still prouoking vs to cough, but in vaine because it hath not a compacted body which the aer might intercept till by time it be ripened, that is, grow thicke and then it is brought vp; or if of it selfe it do not thicken we thicken it by Art. Wee may therefore iustly wonder at this contrary worke of Nature; surely coldnesse in the Lungs can not thicken it, it being so neere to the fountaine of heate nor the ayer which is the moistest of al Elements cannot dry it: besides that, the Lungs are of themselues very moist as we shall prooue by and by. Againe, if heate in the Lungs do thicken it, why should it not thicken it also in the stomacke; but we see that cold stomacks doe onely make thicke and viscid flegme.

A mystery of Nature.

Truely heereunder lyeth a great mystery worthy of another place to be discussed in, to which therefore we will referre it and proceede to the second qualities of the Lungs, and enquire whether they be moist or dry. It may seeme they are dry, because their passages doe alwayes remaine open and neuer fall together, which is an argument of their hardnes and drynesse. Againe, *Galen* saith (in his 4. booke *de vsu partium*) they are nourished with chollericke bloud, but chollericke bloud is dry. Lastly, *Hippocrates* saith the Lungs are the seate of drought; for he appointeth two places of drought, the stomack & the Lungs. Concerning which, is that notable edict of *Hippocrates* (in *Epidemÿs.*) The way to appease and satisfie thirst is to drinke cold water and to breathe in cold aer. These arguments we will first answere before we determine the contrary.

That the lungs are dry Arguments.

Answered.

To the first we answere, that if the opennes of their passages argue their drinesse, then should the braine also be dry whose ventricles are alwayes open and do not fall together in the strongest concussions or motions of the head, as in sneezing and fits of the *Epilepsie* or falling sickenesse. As therefore the braine is harder in the ends of the ventricles thereof (in which respect Anatomists cal that part the Callous body as we shall heare heereafter): So the Lunge where it compasseth the vessell is somewhat harder: or say rather, that the stiffnesse and hardnesse of the branches of the Sharpe and Rough Artery do hold it out & keep the passages in a kinde of distention.

To the second we answere, that *Galen* by bilious or Cholericke blood meaneth thin and attenuated blood laboured in the right ventricle of the heart, which no man will say is drie but rather abundantly moist, as being mingled with aer the moistest as we saide of all Elements. To the last we answere, that the Lungs indeede if they be torrified are the seate of drought, because they dry vp the moisture of the heart and the partes adioyning; but if they be naturally disposed they are no cause of drought. It remaineth therefore that the Lungs are not dry, and then they must needs be moist; which yet further to prooue wee want not arguments beyond all exception. First, because they are soft; for as hardnesse is a sure note of drinesse so is softnesse of moisture, but the substance of the Lungs is soft and lax, of which the very touch is a sufficient witnesse. Besides *Galens* authority is plainely for it, where he saith in his 4. Booke *de vsu partium*, *The flesh of the Spleene is soft indeed & laxe, but nothing to the substance of the Lungs which is the softest, the looseſt and the lightest.*

Galen expounded.

Arguments to proue the Lungs moyst.

Auicen interposeth saying, *That the flesh of the Lungs is not soft of his owne nature but by accident or euent*, because they lie steeped & drunken as it were in the moisture which falleth from the head, therefore he saith they are *not soft but maddid*; which if it were so, then wold they be drier in those bodies that haue dry braines, and moreouer would in al other bodies become drier, as the moisture which falleth from the head is exhausted and dried vp, both which are contrary to all experience. We therefore conclude that the Lungs are naturally moist, and by so much moister then the liuer by how much they are softer. And thus much of the temperament of the Lungs, now followeth their motion. Concerning which I find three opinions; one of *Aristotles*, another of *Auerrhoes*, the third of *Galen* and the Physitians. *Aristotle* in the 6. chap. of his third booke *De Part. animalium* thinketh, that they haue the original of their motion from the heart on this manner.

Auicens conceite.

Confuted.

The determination.

3. Opinions.

Aristotles.

The heate of the heart being encreased, with a kinde of violence lifteth vp the Lungs & then aer entreth for the auoiding of vacuity and emptinesse that infest enemy of nature; the colder aer setleth the boyling of the heate, as we see cold water beeing powred to boyling water setleth it; as therefore in the diffusion of the heate the Lungs are dilated, so the heat residing or setling they are contracted and the aer expressed or driuen out. *Auerrhoes* ioyneth so far with *Aristotle* that he thinketh the heate to be the author of Respiration, but he saith that the Lungs follow not the motion of the Chest, but are mooued by a proper and peculiar power of their owne, because else there should be a violent motion which shoulde be perpetuall, that which is vtterly against the rules of nature. True it is (saith he) that there is a wonderfull consent betweene the Chest and the Lungs, which is the cause that one of them cannot moone or rest but when the other mooueth or resteth, yet neither of them is cause or originall of the others motion. The third opinion is of *Galen* and the Physitians to which also we encline, who thinke the Lunges are not mooued by an inbred or proper power of their owne, for where are their Fibres and the strength of Filaments or strings for that purpose? Neither by the faculty of Pulsation which ariseth from the heart by which the arteries are mooued, & that because the motion of the Lungs somtimes doth intermit, sometimes is quicker and slower as we list: neither by the animall faculty because there be no Muscles: but we conceiue that the Lungs are mooued by an accidentary motion, as following the motion of the Chest to auoid vacuity. For when the Chest is distended the Lungs are filled with aer and enlarged, and when that is contracted they are emptied and fall. *Galen* establisheth this his opinion with this reason, because there is no disposition of the body found wherein the Lungs are mooued when the Chest remaineth immooueable: which thing Experience also confirmeth. For if the Chest be opened so as the aer may get in by the wound, the Lungs become immooueable; because the aer being gotten into the void and empty space taketh away the necessity of the motion of the Lungs which is to auoid vacuity as we haue saide: but if the Chest be sound, it is of necessity that it beeing distended the Lungs also should be dilated for auoyding of that vacuity. And whereas *Auerrhoes* obiecteth that there is no violent motion perpetual, and yet the motion of the lungs should be violent if it should follow the motion of the Chest. I answer, that the inference is very absurd, for euery motion is not violent which is mooued after anothers motion, for by that reason the bones also should be mooued with a violent motion. But why are not the Lungs wearied with their perpetuall motion? I aunswere, because they are almost insensible.

Auerrhoes.

Galens.

The Lunges not mooued by any proper power of their owne.

Not by the faculty of Pulsation.

Not by the Animall faculty.

But by accident or Consequence.

Galens reason.

Experience.

Answere to *Auerrhoes.*

Why the Lunges are neuer wearie.

QVEST. XII. *What kinde of motion the Cough is, and whether any part of the drinke fall into the Lungs.*

What parts are cauſes of coughing.

THat the Cough proceedeth from the affection of almoſt all the partes of the Cheſt, as the *Pleura*, the *Mediaſtinum*, the Lungs with their veſſels, the midriffe, and ſometimes of the *Intercoſtall* muſcles alſo, it is more then manifeſt; For in both the kindes of Pleuriſies, the true and the baſtard, the *Peripneumonia* or inflamation of the Lungs; the *Aſthma* or difficulty of breathing, the vlcer of the Lungs called *Pthoe*, the Dropſie wherein the Midriffe is preſſed vpward: in all theſe I ſay the Patient is troubled with a continuall Cough. But now to what faculty wee ſhould referre this coughing that is a great controuerſie. It may be thought it is Animall and voluntary, becauſe the Cough is nothing elſe but a ſtrong efflation or breathing forth. Now this efflation is done by the helpe of all the muſcles which contract the cheſt.

That the cough is frō the Animal faculty.

Galen alſo in his ſecond Booke *de cauſis ſymptomatum* ſpeaking of ſneezing coughing and vomiting, concludeth that vomiting is a ſymptome of the naturall faculty and coughing of the Animall. Others there be which thinke it to bee an action of the naturall faculty, becauſe it is a concuſsiue motion and is done by the endeuour of Nature, to exclude that which is offenſiue vnto her; now all Concuſsiue motions are Naturall. For all the partes of the body of their owne naturall conſtitution haue euery one their owne ξυσμὸς *i. Concuſſions* when they are ſhaken for the auoyding of any thing which offends them: ſuch is the concuſsion of the brain in ſternutation or ſneezing; of the ſtomacke in the hiccock, of the bladder in auoyding the ſtone, of the whole habite of the body and the fleſhy membrane in a rigor or ſhaking fit, and finally of the cheſt in coughing. Moreouer ſometimes we cough againſt our will, neither can we alwaies when we will forbeare it. Both theſe opinions may be reconciled, if as we ſaide earſt in reſpiration, ſo here in coughing, that it is a mixt action of an Animall and a Naturall.

That it is frō the Natural faculty.

The reconciliatiō of theſe two opinions.

The motion is Animall becauſe it is done by the helpe of muſcles, but the cauſe mouing the motion is Naturall; for a cough is not raiſed without the endeuor of the expelling faculty. But another queſtion may be asked here, whether the cough be a diſeaſe or an ordinary worke of Nature. *Galen* in his ſecond Booke *de ſymptomatum cauſis*, and in his fift *de locis affectis* ſeemeth to determine diuerſly; ſometimes that it is a worke of Nature, and ſometimes againe as in his Booke of *Trembling and Palpitation* that is againſt Nature: but we may well reconcile *Galen* with himſelfe if wee ſay, that in reſpect of the faculty whereby we cough it is a Naturall affection; for the beginning of the motion is from nature, that is from the expelling faculty; but in reſpect of the cauſe which mooueth the faculty as the rheume, the bearing vp of the midriffe or ſuch like, it is againſt Nature and a very diſeaſe; but ouer this cauſe the Naturall faculty hath a kind of power or command which it ſheweth in laboring thus to auoide it.

Whether to cough be a diſeaſe or no.

Galen reconciled to himſelfe.

To conclude both this Chapter and all our diſcourſe of the vitall parts, it is a queſtion whether the drinke we drinke goe into the Lungs or no. *Hippocrates* ſayeth in his Booke *de Corde* ſome part of it goeth that way, becauſe if you giue a Swine a drinke coloured with vermiliō or any ſuch like thing & preſently cut the throat, you ſhal perceiue the wezon colored with the drink, which is a certaine argument & demonſtratiue; alſo in the ſame place hee thinketh that the water which is found in the *heart purſe* is a portion of our drinke: againe Phyſitians in the fretting or exulceration of the weazon, and diſeaſes of the cheſt do appoynt the Patient to lie long vpon his backe and leaſurely to lick down their medicines, that ſo ſome of them may fall downe into the Lungs.

Whether the drink go into the Lungs.

Another demonſtration may be that the arteries haue more whey or vrine in them then the veines; whence ſhould this whay come? but that a part of the drinke and more liquid nouriſhment doth ſlip downe by the weazon into the Lungs and ſo into the arteries, and from them by the emulgent arteries into the kidneyes to bee auoided by the bladder: for I ſee no reaſon why the emulgent arteries ſhould haue beene made ſo large, vnleſſe it were for the expulſion of this excrement. *Ariſtotle* amongſt al the Philoſophers is againſt this. *Hippocrates* in his fourth Booke *de morbis* laboureth might and maine againſt it, yeelding diuers reaſons why it cannot bee: but wee muſt vnderſtand that *Hippocrates* laboureth to prooue that all the drinke goeth not into the Lungs, hee confeſſeth that ſome ſlippeth by. And thus *Galen* in his eight Booke *de placitis Hippoc. & Platonis* reconcileth *Hippocrates* to himſelfe; namely, that ſome of the drinke falleth inſenſibly downe along the weazon, the

Why the emulgent arteries are ſo large.

reſt

reſt paſſeth ouer the *Epiglottis* into the ſtomack: but if neuer ſo little a crum of ſolid meate get into the weazon, it bringeth danger of ſuffocation. So *Anacreon* the Poet was ſuffocated with a Grape-ſtone. And *Fabius* the Senator is ſaid to haue beene ſtrangled with a haire which got into his weazon in ſupping of a draught of Milke. *Alexander Benedictus* writeth that a mother at *Bruſſels* thruſt a pill downe her childes throate with her finger, vpon which it preſently dyed.

Examples of ſuch as haue beene choked with crums or ſuch like.

And thus much ſhall be ſufficient to haue beene ſaide concerning the vitall parts belonging to the middle Region called the Cheſt, with all the Controuerſies and ſubtleties of Nature therto appertaining. It followeth now that we ſhould aſcend vnto the Throne of the ſoule, the Tower of the body, which is the Head.

Concluſion of the diſcourſe of the vitall parts.

The End of the Sixt Booke and the Controuerſies thereunto belonging.

THE SEVENTH BOOKE,

Of the Third and vpper-most Venter called the HEAD, wherein are described the *Animall Organes.*

The Præface,

Wherein is conteyned the ſumme of the firſt Eight Bookes.

AS a Traueller that deſireth to make profit of his paine, when he hath paſſed one Citie before hee enter into another vvill recount with himſelfe his principall obſeruations, eſpecially when the recognition of the former may ſtand him in ſteade for his better vnderſtanding in that to which hee bendeth his courſe: ſo I thinke it not amiſſe hauing paſſed through ſo great variety of partes in the two former Regions of the body of Man, before I enter into the Third, to cal vnto your remembrance (not al the particulars before rehearſed, for that would be itkeſome to vs both Gentle Reader) but the Principall, as wel to refreſh thy memory, as alſo to make a more eaſie paſſage vnto that which followeth.

MAN who is the ſubiect of our whole Diſcourſe, conſiſteth of a Soule and a Body. The Soule is the Lady and Miſtris, the Soueraigne and Commander. The Body is a moſt perfect Organ or Inſtrument of the reaſonable Soule, conſiſting as *Hippocrates* well ſaith (though obſcurely) *of Fire and Water.*

Why the body is made of many organs.

For the Soule, albeit when ſhee is free from the priſon of the Bodye can ſee without an Eye, heare without an Eare and by her owne ſimple act diſcourſe without the help of ſpirits; yet ſo long as ſhe is immured within theſe wals of clay ſhee cannot contemplate the ſpeculations of Externall things without an Externall *medium*; and therefore Nature (by which I vnderſtand the wiſedome of the eternall Creator) framed the body of many Organicall parts whereby and wherein the Soule might exerciſe her Diuine adminiſtrations, produce and exhibit the powers and efficacies of her manifold Faculties. For the Body in deede is but a dead trunke till the Soule arriue into it, and quickneth it vnto the performance of perfect actions of life.

But becauſe the Soule is of all Formes the moſt excellent as being created immediately partaker of immortality, Nature in emulation of the diuine *Numen* hath ſtriuen to make her habitation alſo immortall, which although the deſtiny of the matter did gainſay, yet ſhe hath brought to ſo admirable a perfection that it is worthily called Θαῦμα θαυμάλων, *the wonder of Wonders, the Myracle of Nature, and a Little world.*

why the ſpirit was created.

WHereas therefore there was no proportion or correſpondencie betweene mortality and immortality, betweene the Soule and the Body; Nature with wonderfull skil, out of the principall part of the ſeede did extract and ſeparate a ſpirit which lay lurking in the *power* of the Matter, a ſpirit I ſay of a Middle nature betweene Heauen and Earth, by whoſe mediation as by a ſtrong band the diuinity of the ſoule might be married to the humanitie of

of the body. This instrument of Nature we call Fire, which moueth and illustrateth the whole packe of the members, and moderateth all and singular actions of life, of which also it is the next and most immediate cause.

But because the nature of Fire is such that it hath in it much forme and but a little matter, neither can diffuse the beames of his light vnlesse it be receiued into some substance wherein his power may be vnited; therfore it was necessary there should be another Principle not so subtle, wherein this ætheriall body might expatiate and disport it selfe according to the diuersity of his functions and that without danger of expence. Such a Principle is the mutuall confluence of the seeds of both parents, out of whose slimy matter the *Plastical* or formatiue faculty of the wombe stirred vp by the vigor of heate diduceth and distinguisheth the confounded *power* of the parts into their proper actions, not without a discerning Iudgement and naturall kinde of discourse. This masse of seed irrigated with the *power* of the whole body according to *Hippocrates* I call *Water*; not onely because this Element doth delineate nourish and make fruitefull, but also because the future siccitie and hardnesse of the spermaticall parts stood in neede of a moist and viscid matter whereby those things which otherwise could hardly be sammed together might receiue their conglutination, that so of many dissimilar particles, one continued frame might arise. The second principle.

This farme thus coagmentated and distinguished for the seruice of the soule, we haue in the beginning of this work compared to the whole world or vniuerse, and that not without good ground. For as of the world there are three parts, the Sublunary which is the baest, the Cœlestiall wherin there are many glorious bodies, & the higheſt Heauen which is the proper seate of the Diety. So in the body of man there are three Regions. The lower Belly which was framed for the nourishment of the *Indiuidium* & propagation of mankinde. The middle Region of the Chest, wherein the Heart of man the sunne of this *Microcosme* perpetually moueth and poureth out of his bosome as out of a springing fountain the diuine Nectar of life into the whole body, and the vpper Region or the Head wherein the soule hath her Residence of estate, guarded by the Sences and assisted by the Intellectuall faculties at whose disposition all the inferior parts are imployed. How the body is like the world.

In the lower Region Nature hath placed two parts more excellent then the rest, wherof one endeuoureth & attendeth the conseruation of the *Indiuidium*, the other of the Species or kinde. The first is the Liuer which some haue said is the first of all the bowels, both in respect of his originall & of his nature. It is seated in the right *Hypocondrium* vnder the midriffe. The figure of it (if you except his fissure) is continuall, but vnderneath vnequall and hollow, aboue smooth and gibbous. In a man this bowell is proportionably greater then in any other creature, and greatest of all in such as are giuen to their bellies. The proper *parenchyma* or flesh of this Liuer, which is most like to congealed and adust bloud, by a proper & inbred power giueth the forme, temper and colour of bloud to the Chylus confected in the stomacke, deriued into the guts, prepared in the meseraick veines and branches of the gate-veine by which also it is transported to the hollow part of the Liuer, there as we saide wrought and perfected, and so conueyed by the same rootes of the gate-veine, and thence exonerated into that which is called the *Caua* or hollow veine; by whose trunks and boughes it floweth into the whole body. The temperament of this Liuer is hot and moist; for the moderation of which heate and conseruation of the spirits therein contained it receiueth certaine small Arteries which attaine but onely vnto the cauity thereof. It is inuested round with a thinne coate wherein two small Nerues belonging to the sixt conIugation of the braine are diuersly dispersed. The lower Region. The Liuer.

We say moreouer; that this same Liuer is the shop or work-house of the venall bloud and the originall of the veines; in whose thrummed rootes the more aery portion of the Aliment is conuerted by the in bred and naturall faculty of the Liuer into a vaporous bloud, which becommeth a naturall, thicke and cloudy spirit, the first of all the rest and their proper nourishment: which spirit is the vehicle of the naturall faculty, and serueth beside to helpe to transport the thicker part of the bloud through the veines into the whole bodye; where it needeth but a little ayer and therefore is refreshed and preserued only by Transpiration made by the Anastomoses or inoculations of the Arteries with the veines in their extremities or determinations. This Naturall faculty (we before mentioned) is diuided into three faculties, the Generatiue, the Alteratiue and the Increasing faculty. Of the Generatiue we shall speake by and by. The action of the Alteratiue faculty is Nutrition which hath many handmaides attending her, Attraction, Expulsion, Retention, and Concoction. The Naturall faculty.

on. The action of the Increasing Faculty we call Accretion, that is, when the whole body encreaseth in all his dimensions. Finally, wee say that Concupiscence as it is a distinct Faculty from Reason and Rage, ruleth and beareth sway in the Liuer as in her proper Tribunall, and is distinguished into *Libidinem & Cupediam*, *Lust* and *Longing*.

The partes of Generation.

But because in all her workes Nature euer intendeth immortality, which by reason of the importunate quarrell and contention of contraries she could not attaine in the *indiuiduum* or particular, she deuised a cunning stratagem to delude the necessity of Destiny, & by an appetite vnto the propagation of the kinde, hath sowed the seedes of eternity in the nature of Man. For the accomplishing of which propagation shee hath ordained conuenient instruments in both sexes, which are for the most part alike, but that the instruments of the Male are outward, those of the Fœmale for want of Naturall heate to driue them foorth are deteyned within. The Chiefe of these are the Testicles, two Glandulous bodies of an ouall Figure which in men hang out of the *Abdomen* and are inuested with four Coats, whereof two are common, the *scrotum* or Cod a thin and rugous skinne, and the *Darton* which hath his originall from the fleshy Panicle. The other two are Proper, the former is called *Erytroides*, and the latter *Epididymis*. The temperament of these Testicles is hot and moyst, and they haue a very great consent with the vpper parts especiallie with the Middle Region, as also hath the wombe. The manner of the Operation of the Testicles is thus.

The Testicles

The matter of the seede, together with the spirites carrying in them the forme and impression of all the particular parts and their formatiue Faculty, falleth from the whole body and is receiued by the Spermaticall Vesselles, in whose Labyrinths by an irradiation from the Testicles it is whitened. After it is so præpared it is conveighed to the *Epididymis* thorough whose insensible passages it sweateth into the spongie and friable substance of the Testicles themselues; where hauing atteined the forme and perfection of seede it is deliuered ouer by the eiaculatory or rather the Leading-vessels to the *Parastatæ*, and from them transcolated to the *Prostatæ*, which reserue the seed being now turgid and full of spirits for the necessary vses of Nature. Hence it followeth that that power which is called σπερματοποιητική, that is, the *seede-making* Faculty, or the Faculty of generation, is from the Testicles immediately, by which Faculty the parts being stirred vp do poure out of themselues the matter of the seede when *Venus* dooth so require. This Faculty is the authour in men of Virility and in women of Muliebrity and breedeth in all creatures that ὁρμὴ by which the heate being blowne vp is the cause τῆς ὀργῆς, so that the bloode being heated and attenuated distendeth the Veines, and the bodie or bulke of that part groweth turgid and impatient of his place, which the Grecians call ὀργᾶν. And thus much of the Lower Region.

The Middle Region.

In the Middle Region there are many parts of great woorth, but the excellencie of the Heart dimmeth the light of the rest, which all are to it but seruants and attendants.

The Heart.

The Heart therefore is called καρδία ἀπὸ τοῦ καδαίνεσθαι, which signifieth *to beate* because it is perpetually mooued from the ingate to the outgate of life.

This is a Pyramidal Bowell whose *Basis* is in the middle of the Chest, the *mucro* or point reacheth toward the left side. The magnitude but small that the motion might be more free and nimble, the flesh very fast and exceeding hot intertexed or wouen with all three kinds of Fibres, and nourished with bloode which it receiueth from two branches of the Coronary Veine.

On the out-side it hath a great quantity of fat and swimmeth in a wateriſh Lye which is conteyned in the *Pericardium* wherewith as with a purse the Heart is encompassed.

On the inside it is distinguished by an intermediate *partition* into two Ventricles. The right is lesse noble then the left and framed moſtwhat for the vse of the Lungs. It receiueth a great quantity of blood from the yawning mouth of the Hollow-vein, and after it is prepared, returneth the same blood againe through the Arteriall veine into all the corners of the Lunges. This right ventricle hath annexed to it the greater eare and sixe Values are inserted into the Orifices of his vessels. The left Ventricle which is also the most noble hath a thicker wall then the right, because it is the shop of thin blood and vitall spirites. Out of this Ventricle do two vessels issue, the first called the Venall artery which receyueth the ayer prepared by the Lungs and for retribution returneth vnto them vitall blood and spirits; at which artery the left deafe eare is scituated, and in whose orifice there stande two Values bending from without inward. The other vessell of the left Ventricle is the *Aorta*

or

or great Artery which diſtributeth vnto the whole body vitall blood and ſpirits. For according as the opinion of ſome is, it draweth the better part of the Chylus by the Meſeraicke Arteries into the boſome of the left ventricle for the generation of arteriall blood, and at his mouth do grow three Values opening inward. We ſay further that the Heart is the habitation of the vitall Faculty, which by the helpe of Pulſation and Reſpiration begetteth Vital ſpirits of Ayer and Blood mixed in the lef ventricle. And this Faculty although it be vitall yet is it not the *life* it ſelfe, and differeth from the Faculty of Pulſation both in the functions and in the extent and latitude of the ſubiect. The Faculty of Pulſation is Naturall to the heart, as proceeding and depending vpon the Vitall Faculty. For it is not mooued προαιρετικῶς or voluntarily as is the Animall Faculty, but onely obeyeth the command of the neceſsity of Nature. The Vitall faculty.

From the foreſaide Faculty of Pulſation do proceede two motions, the *Diaſtole* & the *Syſtole*, betweene which there is a double Reſt. Theſe motions in the Heart and Arteries are the ſame and at the ſame time, but ſo, that the cauſe of the motion is ſupplied from the Heart vnto the Arterries as from a principle both mooued and moouing.

Finally, to come vnto that which we are now in hand withall. In the vpper Region wee meete with the Braine compaſſed with the ſtrong battlements of the ſcull, adorned with the Face as with a beautifull Frontiſpice wherein the Soule inhabiteth, not onely in eſſence and power as it is in the reſt of the body; but in her magnificenſe and throne of ſtate. This Braine is the moſt noble part of the whole body and framed with ſuch curioſitie, ſo many Labyrinthes and Meanders are therein, that euen a good wit may eaſily bee at loſſe when it is trained away with ſo diuers ſents in an argument ſo boundleſſe and vaſte. Notwithſtanding we will as briefely and ſuccinctly as we can giue you a viewe of the Fabricke and Nature thereof, referring the Reader for better ſatisfaction to the enſuing diſcourſe, wherein we hope to giue euen him that is curious ſome contentment. The vpper Region.

The ſubſtance therefore of the Braine is medullous or marrowy, but a proper marrow not like that of other parts; framed out of the pureſt part of the ſeed and the ſpirites. It is moouable and that with a naturall motion which is double, one proper to it ſelf, another comming from without. It is full of ſence, but that ſence is operatiue or actiue not paſsiue. For the behoofe of this braine was the head framed, nor the head alone but alſo the whole body, it ſelfe being ordained for the generation of animall ſpirits and for the exhibiting of the functions of the inward ſenſes and the principall faculties: in this brain we are to conſider firſt his parts then his faculties. The Braine.

The Braine therefore occupieth the whole cauity of the skull, and by the *dura mater* or hard membrane is diuided into a forepart and a backpart. The forepart which by reaſon of the magnitude retaineth the name of the whole and is properly called the Braine, is againe deuided by a body or duplicated membrane reſembling a mowers ſythe, into a right ſide & a left, both which ſides are againe continued by the interpoſition or mediation of a callous body. This callous body deſcending a litle downward apeareth to be excauated or hollowd into two large ventricles much reſembling the forme of a mans eare, through which cauities a thrumbe of criſped veſſels called *Plexus Choroides* doth run, wherein the Animal ſpirits receiue their preparation; and out of theſe Ventricles doe yſſue two ſwelling Pappes which are commonly called the Organes of ſmelling and do determine at the ſpongy bone aboue the top of the noſe.

Theſe two venticles are diſſeuered by a fine and thin body called *ſpeculum lucidum*, or the *bright Glaſſe*, vnto which adioyneth the Arch of the braine called *Corpus cameratum* which is ſupported by three finials or Columnes which like *Atlas* do ſuſtaine the weight of the braine, ſo that the thirde ventricle which lieth vnder them is not obliterated. This middle ventricle which is a common cauity of the two vpper, occupieth the very center of the braine and runneth out with a double paſſage. The firſt deſcendeth to the Baſis of the braine where the originall of the Nerues is moſt manifeſt, and the extremity thereof endeth in a portion of the *Pia mater* or thinne membrane very like vnto a Tunnel, through which Tunnell the flegmaticke excrement of the braine is tranſcolated into the pituitary glandule thereunder diſpoſed, and ſo thorough the holes of the wedge-bone diſtilleth into the Pallate of the mouth.

The other paſſage of the thirde Ventricle which is larger then the former is directed vnto the fourth Ventricle where the Glandule or Kernell called κονάριον is ſeated, at each ſide of which do adioyne the *Buttockes* of the Braine, and vnder them the *Teſticles* appeare,

which

which ſeuer the paſſage of the Animall ſpirit out of this into the fourth ventricle. Finally, the fourth ventricle ſucceedeth, which is the leaſt and moſt ſolid of all the reſt, and wherein ſay ſome, the Animall ſpirit receiueth his vtmoſt perfection, and therefore it is made in the Cerebellum that is, the backe-ward or after-braine, which for this very reaſon was framed of a harder conſiſtence then the former. And ſo much of the parts of the braine.

The Animall Faculty.

Now for the faculties; we determine that the Braine is the Pallace of the Rationall Soule, which ſoule vſing for her inſtrument the temper & confirmation of the braine, according to the diuerſity of her functions bringeth forth mixt actions by the mediation of the animall ſpirit. Theſe very actions, produced according to the variety of the temperament and *medium*, into diuers acts of Ratiocination Imagination and Memory as the ſoule is beſt pleaſed to worke, we call Faculties; which are ſeated and eſtabliſhed together & promiſcuouſly in one and the ſame place.

Againe, we ſay that this braine as it is the beginning of the inward, ſo is it alſo of the outward ſenſes, from which each of them receiuing their proper veſſels or paſſages together with their Faculty do ſuffer the incurſions of Species or Images reſorting vnto them according to the diuerſity of the Organe. The eye receiueth the viſible formes, the eare the audible, the noſe ſuch as caſt an odour from them; and ſo of the reſt. All theſe indiuiduall formes receiued by the ſences, are by them reſigned vp in token of fœalty to the Common ſenſe or priuy-chamber of the ſoule from whence they receiued their faculties: and then out of thoſe formes the ſoule gathering phantaſmes or notions doth eyther lay them vp in the Memory, or worke vpon them by diſcourſe of Reaſon. Finally, we attribute to the braine the faculties of ſenſe or motion, which faculties together with the animall ſpirit differing in forme and kinde from the vitall, and prepared concocted and perfected in his ventricles and ſubſtance, he doth continually and without intermiſsion tranſmit through the ſame Nerues into the whole body to ſupply the expence of the foreſaide ſpirits, which is made either by action or by paſsion.

And thus haue wee runne through not onely the two lower Regions to refreſh our memories, but alſo the vpper, wherein the Reader may haue ſuch a taſte of that which followeth, as may haply make him ſauour it the better when he commeth thereto. And ſo wee proceede to our buſineſſe.

CHAP. I.

Of the Names, ſcituation, forme and parts of the head.

HAuing hitherto as exactly as we could and with great leaſure made our progreſſe through the two lower Regions Naturall and Vitall. It is now time we ſhould aſcend into the third venter, the ſeate & very reſidence of the ſoule, the ſacred Pallace or Tower of Pallas, & there ſuruay her royall Court, her guard of outward Sences, her Counſellors of ſtate and all their æquipage.

The names of the head.

This Region therefore is by the *Græcians* called κεφαλὴ κάρτον & καρήνον. *Appians* Interpreter holds it was called κεφαλὴ, of a word which ſignifieth to grow dry, becauſe being of a bony ſubſtance it muſt needs be dry. *Apollidorus* deriues it from the word καλύπτω to hide or couer, becauſe it is the couering of the braine. Others becauſe there κεῖνται τὰ φάη the lights are placed. Others ἀπὸ τῦ κεκυφῶσθαι, from the Cauity or hollownes of it. The *Latines* call it *Caput*, becauſe from hence the ſences do *Capere initium* take their beginning.

A ſtrict ſignification. *Celſus* deſcription of the Head.

There is a double acception of the word *Caput* among Phyſitions, one ſtrickt & preſſe, another large and ample. In the ſtrict ſignification it is vſed by *Celſus* out of *Hippocrates* booke of the wounds of the head and thus diſcribed. The Head is the Manſion and skonce of the braine, whoſe skull is made of two Tables, between which is a marroweye ſubſtãce called *Diploïs*, inuironed with Caruncles and ſmall veines, ouer which is ſpread the membrane called *Pericranion*; which Membrane is couered againe with the hairy ſcalpe; but vnder the skull lyeth the Membrane called *Dura mater*. And in this ſignification the antients called it ἄλγειον τῦ ἐγκεφάλε, the Veſſel of the braine; we alſo in our common ſpeech cal it the *Skonce*.

Skonce.

The large ſignification.

But in the large and ample ſignification, vnder the name of the head we vnderſtand all that is circumſcribed within the firſt racke-bone of the Necke and the top of the Crowne. We will intreate of it in this large ſignification: wherein therefore we are to conſider of the

the forme, the ſcituation, the magnitnde, the frame and ſtructure, the motion & the particular parts thereof.

Firſt therefore the head was made round and that for diuers reaſons. Inprimis. That it might be of greater receipt and capacity, becauſe it was to receiue the vaſt and huge bulke of the Braynes. For the braines of a man are foure times as big as of an Oxe: now of all figures the round figure is of moſt capacity, witneſſe the world it ſelfe. The forme.

Secondly, the head was made round *ad ſυσπάθειαν*, that it might bee leſſe ſubiect to outward iniuries nor ſo eaſily wounded. For this figure as it is moſt capacious, ſo is it the ſtrongeſt, becauſe it hath no aſperity whereupon a blow might faſten, but is euery where alike ſmooth, hauing no point whence the diſſolution of it ſhould commence. Why round.

Thirdly, the head is round for his better motion, that it might be ſpeedily and eaſily turned to euery ſide. The *Platomiſts* thinke that the head was therefore made round, becauſe it is the ſeate and habitation of the ſoule. For the ſoule is infuſed into vs out of heauen which is round. Adde heereto that the moſt Noble member deſerued the moſt noble figure.

Notwithſtanding though the figure of the head be round, yet is it not exquiſitely and to a haire globous, but ſome what long, ſwelling out with two tops like promontories, which therefore they call heads of land; it is alſo preſſed on the ſides. Long it was to containe the braine and the Cerebellum, ſwelling out before becauſe of the mamillary proceſſes which are the Organes of ſmelling, and behind to admit the originall of the marrow of the backe. Why compreſſed.

It is preſſed on the ſides, but more forward: firſt becauſe the proceſſe of the backe called *Dorſalis* is much thicker then that ordained for the outlet of the Nerues of the face. Secondly, becauſe in the forepart there was to be a boſome or hollowneſſe, into which the aer was plentifully to paſſe, that is, the mouth. Thirdly, that the eyes rowling on eyther ſide, might not haue their proſpect hindred by the bones of the temples, which would haue beene if the skull in that place had beene more embowed. Laſtly, that the head might ſtand equally ballanced; for ſeeing the forepart hath his waight increaſed by the Iawes, the head would haue waighed too much forward if the back-part had not beene more embowed and runne out as it were into a knowle, which therefore with little alteration in the word and leſſe in the ſence we call the *nowle* of the head. More on the fore-part.

But deſcanting thus about the figure of the head, it muſt be vnderſtood that we meane a head Naturally diſpoſed; for otherwiſe of vnnaturall formes ſome are perfectly round, others do riſe vp in the toppe likk a ridge almoſt of a houſe, bearing little bredth in the Crowne. The round head they call in Greeke *σφαιροειδὲς* becauſe it hath no *προβολὴν* or ietty eyther in the forehead or in the nowle. The ſharpe or turbinated head is called *ὀξὸς* or as *Athenæus* hath it *ὀξόκρανος* becauſe to them that behold it, it ſeemeth ſomewhat ſharpe like a ſuger-loafe. Such a head had *Therſites* in *Homer* much like thoſe moulded Cups among the *Græcians* which were called *ὀξυκύκλα*. *Euſtathius* rather thinketh it is called *ὀξὸς* quaſi *φλοξὸς* of *φλὸξ* which ſignifieth flame, becauſe flame endeth in a ſharpe Cone or ſpire. But of the formes a little more heereafter when we will alſo exhibite the pictures both of the Naturall and of the vnnaturall formes. Naturall heads. Vnnaturall. *Therſites* in *Homer*.

The magnitude of the head is diuers in diuers creatures, yet greater in man then in any other, becauſe his braines are of a bigger bulke. A little head is alwayes faulty, becauſe it argueth both the impotency and weakneſſe of the forming faculty and alſo the want of ſpermaticall matter. Whence it is that Phyſiognomers ſay, that a little head betokeneth a ſudden and raſh wit, becauſe in ſuch there is want of ſpirits, which being pent vp in a narrow roome, are heated aboue meaſure, and beſide haue no ſpace to mooue themſelues in. The magnitude. A little head.

A great head, if other things be æquall, that is, if there be an equal proportion of all the bones is alwayes laudable. Whence *Hippocrates* in the ſixt Book of his *Epidemion*, ſayeth that we muſt eſteeme and meaſure the nature of the bones according to the magnitude of the head: not that the bones doe ariſe from the head, but becauſe all the bones ſhould proportionably anſwere to thoſe to which they are articulated or ioyned. For example, The bones of the arme to the ſhoulder bones, the hippes to the holy-bone, the holy-bone to the racke-bones, the racks to the marrow of the back, the marrow to the brain, the brayn to the skull. A great head. *Hippocrates* expounded.

But *Ariſtotle* in his Problemes ſayth that a man is the wiſeſt creature, becauſe he hath *Ariſtotle* expounded.

a little and a short head. We must vnderstand that by *paruitie* he meaneth the thinnesse of the bones and the flesh, not that the inward cauity of the skull is little in respect of other creatures.

The scituation.

The head is scituated in the highest place, because say the *Platonists* it behoued that the intelligible faculty of the Soule, as the Queene and Princesse of the rest should sit in an eleuated Tribunall, that the *Irascible* and *Concupiscible* faculties as handmaydes should rest at her feete, be seruiceable vnto her and obey her commands. *Galen* doeth not say in his 8. Booke of the *Vse of parts* (though *Auerrhoes* would father it and fasten it vpon him) that the head was made for the eies; (for it was made onely for the braine) but he saith indeede that it was lifted vp into the highest place because of the eyes. For the eies being ordained as scout-watches, to looke out for vs night and day; it was requisite that their station should bee in the highest place; but because the sight stoode in neede of the softest sinew and the shortest, least his soft body if it had beene any thing lengthned might haue beene in danger of breaking: therefore it was necessary that the braine which is the originall of sinewes should be placed neare the eies: neither doth this scite of the braine auaile the eies onely, but also all the sences, for the smel better apprehendeth an ascending vapour, and the voice is better heard from aboue.

Galen. *Auerrhoes.*

Why the brain is set highest.

The parts of the head and their names.

The Head is diuided into two parts, the one is hayrie the other without haire: the hairy part is called τριχωδὴς, *Calua* the scalp; that which is without haire is called πρόσωπον, *Facies* the face. The scalpe from the cauity and roundnes of it is called by *Aristotle* in the first Booke of his Historie of creatures and the 7. Section, and by *Pollux* σκαφίον. This comprehendeth all the vpper part, backward as farre as the haire groweth, forward to the forehead: it hath three partes. The forepart reacheth from the foreheade to the Coronall suture or crowny seame & taketh vp almost halfe of the head; it is called βρέγμα ἀπὸ τοῦ βρέχειν which signifieth to water, because it is the softest and the moystest; *Sinciput* also of the Latines, as if it were *summum caput* the top of the head, although there be a higher place.

The parts of the scalp.

The backpart of the scalp reacheth from the Lambdall suture to the first rack-bone of the necke. *Hippocrates* in his Booke *de vulneribus capitis*, calleth it κοιλίς. *Aristotle* ἴνιον διότι ἰνώδεις καὶ νευρώδεις εἶναι, because it is fibrous and neruous, for many tendons reach vnto it; beside almost all the nerues arise from about that part, in Latine *occiput* or *occipitium* as *Plautus* hath it; we call it the nowle. The middle part of the scalpe betweene these is gibbous or round called in Greeke κορυφὴ of κρύπτω to hide as it were κρυφὴ, because that part of the head is especially couered with haires.

Hippocrates. *Aristotle.*

Galen in the 11. Booke of the *Vse of parts* and the 14. Chapter, calleth it *aruum pilorũ* the Field of haires: the Latines call it *vertex*, because in that place the haires runne round in a ring as waters doe in a whirle-poole. Finally, the sides of the scalp betwixt the eyes, the eares and the necke are called κρόταφοι, παρὰ τὸ κροτεῖν περὶ τὴν ἀρτὴν, sayeth *Aristotle* in his first Booke of his History and the eleauenth Chapter, because the pulse is there very manifest, the Latines cal them *Tempora*, because their gray haires and sunken flesh bewray the age of a man.

Galen.

Another diuision of the parts. Containing.

Againe, the parts of the scalp are contayning and contayned. The contayning parts are some of them Common some proper. The Common, are the *Cuticle* or scarfe skinne, the true skinne bearing a wood or bush of haire, the fat and the fleshy pannicle. The proper contayning parts are either externall or internall. The externall are two membranes, *pericranium* and *periostium*, certain muscles and the bones of the head. The proper inward conteyning partes are the two mothers called *Meninges*, *dura* and *pia*, which encompasse both the skull and the braine.

Contained.

The parts contayned are the braine and the *Cerebellum* or after-braine, from which ariseth the marrow, which when it is gotten out of the skull is properly called the marrow of the backe, or pith of the spine, from which doe arise many nerues as well before it issue out of the skull as after. Of these we will first entreat, and then after of the part without hayre or the face in the booke following.

CHAP. II. *Of the common containing parts of the head.*

5. common parts.

THE common contayning parts of the head are fiue; the Haires, the Cuticle, the Skinne, the Fat and the fleshy pannicle; of all which wee haue spoken heretofore at large; yet because in euery one of these there is some difference from the same parts in other places of the body wee must a little here insist vpon them: and first of the haires. Albeit

Albeit therefore the haire is generally more or leſſe all ouer the body as before is ſayd, yet aboue all places the head is adorned with the greateſt aboundance of them. The haires of the head are the longeſt of the whole body, becauſe ſayeth *Ariſtotle* in his firſt Booke *de Gencratione Animalium* and the third Section the braine affoordeth toward their nouriſhment a large ſupply of humour or vaporous moyſture whether you will, which alſo is moſt clammy and glutinous. For the braine is the greateſt of all the glandulous bodies. They are alſo in the head ſtiffeſt, becauſe the skinne of the head is the thickeſt, yet is it rare and full of open pores, ſo ſayeth *Galen* in his ninth Booke *de vſu partium* and the firſt Chapter. In the head Nature hath opened conſpicuous and viſible waies for the vaporous and ſmoky or ſooty excrements, for the head is ſet vpon the body as a roofe vppon a warme houſe, ſo that vnto it doe ariſe al the fuliginous & vaporous excrements from the ſubiected parts The haires of the head are called in Latine *Capilli*, as it were *Capitis pili*, by *Pollux* and *Eſchylus* κόρση of κείρω to cutte. In men they are called ἐθείραι *Cæſaries*, becauſe they are often mowed; in women κόμη of κομέω to dreſſe with diligence, from whence haply wee haue our worde to combe, or rather from the Latin word *Coma*, whoſe ſignification is all one with the former. In woemen they are diuided by a line, which ſeparation the Greeks call λύσωμα the Latins *diſcrimen* and *æquamentum*, in Engliſh we cal it the *ſhed of the haire*.

Ariſtotle.

Galen.

Pollux.
Eſchylus.

The skinne of a man although in compariſon of other creatures it is moſt thinne; yet if you compare the skinne of the head with that of the cheſt or the lower belly it is very thick as alſo is the cuticle. And therefore *Columbus* inſulteth ouer *Ariſtotle* for ſaying that the skinne of the head is very thinne. The place is in the 3. Booke of his hiſtory and the eleauenth Section, where hee doth not ſay that the skinne of the head is very thinne, (for in the fift Booke *de Generatione Animalium* and the third Chapter, hee calleth the skinne of the head παχύλεπτον, that is, very craſſe and thicke) but he ſaith and that truely that the skinne of a man in reſpect of his magnitude is very thin.

The skin of the head.

Ariſtotle redeemed.

Well, the skinne of the head as it is the thickeſt, ſo ſayeth *Galen* in his ſecond Booke *de Temperamentis* and the 5. Chapter, it is ſo much drier then the skinne of the reſt of the body by how much it is harder; yet is it rare ſayeth *Ariſtotle* in the place next aboue named, that the ſooty excrements might be auoided for the generation of haire as before is ſayed. It hath veſſelles running in it, Veines from the outward braunch of the externall iugulars, which creeping on both ſides are vnited in the forehead, and are ſometimes opned in grieuous paines of the head, and theſe veines running vnder the drie and hairie skinne carrie bloud vnto it for nouriſhment. Arteries it hath alſo from the outward branch of the *Carotides* deriued to the rootes of the eares and to the temples eſpecially, which bring Vitall ſpirits vpward from the Heart.

The veines.

Arteries.

It receyueth alſo certaine endes of Nerues reflected vpward from the firſt and ſeconde coniugation of the Neck to giue it ſenſe. I ſaide ends of Nerues, for ſo ſaith *Gal.* in his ſixeteenth booke *de vſu partium* and the 2. Chapter. The skinne hath not a proper & definite Nerue belonging vnto it as euery Muſcle hath his Nerue diſſeminated in or about his body but there attaine vnto it certaine Fibres from the ſubiected parts which connect or knit it to thoſe parts, and alſo affoord ſenſe vnto it. The ſenſe of this skinne of the heade is not fine and exquiſite as in the Cheſt or the Lower belly. *Ariſtotle* in the third booke of his Hiſtorie and the eleuenth Chapter ſaith, it hath no ſenſe at al and rendreth a reaſon becauſe it cleaueth to the bone without any interpoſition of Fleſh. But *Galen* diſprooueth this opinion in his ſixeteenth Booke of the Vſe of Parts and the ſecond Chapter. It may bee *Ariſtotle* meant the Cuticle and not the true skinne. Or excuſe him as *Archangelus* dooth, who ſayth that he meant it of the true skin, but as it is a ſimilar part diſtinct from a Nerue, for indeede onely the Nerues haue ſenſe. *Bauhine* and *Laurentius* giue another reaſon why the skinne of the Heade is leſſe ſenſible, becauſe (ſay they) in the Heade the skinne adhereth but to a Muſculous or fleſhie Membrane, whereas in other parts it cleaueth to a Nerueous Membrane.

Nerues.

An elegant place in *Galen*

Archangelus.

Why the skin of the head hath but a dul ſence.

The vſe of the skin of the head is to compaſſe the ſcull and be a couering vnto it.

The vſe.

There is no fatte at all ſaith *Platerus* vnder the skinne of the Heade, and hee giueth his Reaſons, firſt becauſe there is no vſe of it, for the ſmall veſſelles vnder the hairie Scalpe are placed in ſufficient ſafetie, there needed therefore no Fatte at all to ſecure them. Secondly, becauſe there had beene an abuſe of it. For in the infant the Head is proportionably to the other partes exceeding great, but if it had any fatte about it, it woulde haue

The fat.

Platerus.

bene a great *remora* or impediment in the birth. But *Veſalius* in his ſeuenth Booke & the 18. chapter ſaith, that a man may eaſily with his hands diuide the skin with the fat and the fleſhy Membrane from the ſcull. And *Columbus* ſaith that beſide the Yard and the Codde there is no part but a man may finde fat in it. The trueth is, that in the fore-head there is none at all, for becauſe in the fore-head the skin is moued at our diſpoſition it would haue beene a hinderance to his motion, for that in this place the skin is vnited to a Muſculous ſubſtance, but in and about the *Occipitium* or nowle of the heade there is ſome fat to bee found.

Veſalius. *Columbus*

The Fleſhie Membrane. *Fallopius.*

The fleſhy Membrane ſpred vnder the skin cleaueth cloſe vnto it in the foreheade, becauſe there is no fat to ſeparate them, and there this Membrane is very thick. It alſo ſometimes runneth like a Tendon from the Muſcles of the forhead to the Muſcles of the nowle and the eares, inſomuch that *Fallopius* warneth vs to take heede leaſt we miſtake it for the *Pericranium*, and the *Pericranium* for the *Perioſtium*. And thus much for the common inueſting parts of the Head, how they differ from the ſame parts in other places of the Bodie.

CHAP. III. *Of the Pericranium Perioſtium, and the Muſcles about the Head.*

Pericranium.

Fallopius.

THE Membrane which lyeth next vnder the fleſhye Pannicle is called περικράνιος, becauſe it compaſſeth the whole ſcull on the out-ſide. The Arabians call it *Almocat* and *Almocatin*. *Laurentius* woulde haue it called *Perioſtium*. And *Fallopius* in his Inſtitutions and in his Booke *de Oſsibus* and the 19. chapter ſaith, that this Membrane is common to all the Bones about the ſcull & called *Pericranium*, but by his common name *Perioſtion*. It is ſcituated betwixt the fleſhy Panicle and the *Perioſtium*, to both which it is tied by certaine Fibres. Soft it is and thin, but thight and ſolid ſaith *Laurentius* and of exquiſite ſenſe. It ariſeth from certaine proceſſes of the *Dura Meninx* like thin Membranes or rather Ligaments (for they haue the vſe of Ligaments) paſſing through the ſutures or ſeames of the ſcull. For euerie one of theſe Ligaments are extended ouer that part of the ſcull againſt which they yſſued, and going on meete one with another and are exactly vnited ſo that all of them put together make a common membrane. This membrane dooth not onely encompaſſe the ſcull, but alſo the temporall Muſcles although the Anatomiſtes commonly take it in that place for the coate of the temporal Muſcles or for a Tendon of them, making them to haue two Tendons, one outward another inward, whereas indeede ſaith *Fallopius* in his obſeruations it is nothing elſe but a part of the *Pericranium*. Yet doth it not clothe theſe Muſcles ſo farre as to their inſertion, but onely as farre as the Iugall bones and that for their ſafegarde; and the better it may doe them this good turne becauſe in that place it is thicke and harde; it parteth therefore from theſe Muſcles neere vnto the Iugall bone as is ſaid, where betweene the Membrane and the Muſcles on either ſide there is a little what of fat to be found.

His originall.

Progreſſe.

His vſe.

The vſe of this *Pericranium* is to binde and rowle the ſcull on the outſide round about as it were with a rowle or ſwathing band whereby his bones are firmed; it knitteth alſo the *Dura Meninx* to the ſcul, and hangeth it ſo that it cannot fall or preſſe vpon the Braine. *Platerus* addeth that it tyeth vnto it ſelfe the skin of the head and that very ſtrongly, becauſe there is no fleſh nor fat betweene them, and that is the reaſon that onely the skinne of the head when it is wounded needeth not to be ſewed together, becauſe the lippes of it doe not nor cannot ſtart farre aſunder being held together by this membrane.

Platerus.

Perioſtium. *Falopius.* *Bauhine.*

Next vnder this lyeth the *Perioſtium*, which ſaith *Veſalius* you may ſeuer from the *Pericranium* with the point of a knife, although *Fallopius* thinke they are both one, and *Laurentius* conceyueth that Anatomiſts are deceiued by the thickneſſe of the *Pericranium*, which heere was neceſſary becauſe it couereth a noble bone. But *Bauhine* whom we wil now follow deſcribeth them ſeuerally. The *Perioſtium* therefore is a Neruous Membrane and therfore very ſtrong and thin. It cleaueth very ſtrongly to the ſcul as alſo it doth to the reſt of the bones; the reaſon is, becauſe the bones being very hard ſubſtances would not bee altred or affected with any obiect, & ſo want the benefit of the Tactile quality, vnleſſe they had beene couered with this Membrane of exquiſite ſenſe, by whoſe aſsiſtance now they are not deſtitute of feeling; whence by the Grecians it is called περιοστεον, that is, *Circum oſſalis* about the bone; for it compaſſeth all the bones excepting the teeth onely ſaith *Varoline*, but we may alſo except the inſide of the ſcull and the articulations or ioyntes of the bones,

How the Bones feele.

bones; for if it had beene extended ouer the ioynts we could not haue mooued them without paine. Some, saith *Columbus*, being ignorant of this Membrane haue maintayned that the bones themselues are not destitute of sense.

The Muscles about the head are very many, some arise from the lower part of the scull, others are disposed vnder the skinne of the fore-head mooving it for the behoofe of the eyes, whereupon the skinne of the fore-head is rugous, full of transuerse and right lines; some also there are couched vnder the hairy scalpe, sometimes (for they are not perpetuall) by which the whole scalpe and the eares in some men are mooued; Finally, others belong to the neather iaw (for the vpper is immooueable) of all which we shall particularlie entreate in our Booke of Muscles. The Muscles about the head.

CHAP. IIII. *Of the diuers Figures of the Head, the Sutures and substance of the Scull.*

BEfore we come to entreate of the Bones and Sutures of the scull, which we purpose in this place but lightly to handle, it shal not be amisse to adde a little to that which hath beene already saide concerning the whole figure and fashion of the head, because if the figure be changed then must the Sutures or seames needs alter both in scituation and in number, as *Hippocrates* saith in his booke *de Ossibus*, and after him *Galen* in diuerse places, although I knowe that there are some great Anatomists who are not of this minde.

Table 1. *sheweth the Figures of the Head. Fig.* 1. *exhibiteth the Natural and blameless conformation of the Heade on one side, the other foure Figures are all depraued & faulty.*

TABVLA I.

FIG.II.

FIG.III.

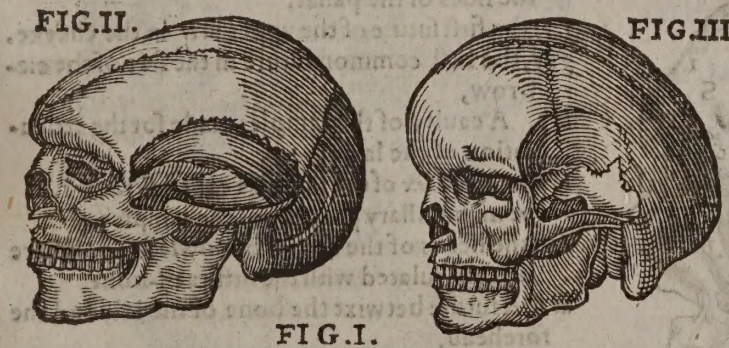


FIG.I.

FIG.IIII.

FIG.V.

The Figure therefore of the head is double, Naturall and Good, or else depraued. The Naturall Figure [Ta. 1. fig. 1] is that which is like a long sphere, on both sides nere the temples by little and little depressed and made narrower, but at each end shooting out; yet so that the backe parte is more capacious, that so it might stand vppon the Necke equally balanced. For because the fore-part though it be not so much compassed nor so much embowed, yet by reason of the bones especiallie of the vpper iawe is some-what heauy, it was needfull that the back-part should be made as heauy by the capacity therof. A double Figure of the head. Natural.

The depraued figure is what soeuer varieth from the former description. I dare not cal it in opposition to the former Vnnatural, because some very good Anatomistes haue interposed their iudgementes & determined that all figures of the head are Natural, albeit they vary somewhat from the exact forme: yet *Archangelus* calleth these depraued figures *Præter Naturam*. Depraued 5.

This depraued figure *Galen* in his ninth booke *De vsu partium* and the 17. chapter calleth by a Generall name φοξὸν, for in that place he reckoneth the round and globy head as a kinde of that φοξὸν. There be three sortes of them. The first

Table 2. sheweth some bones and sutures of the head.

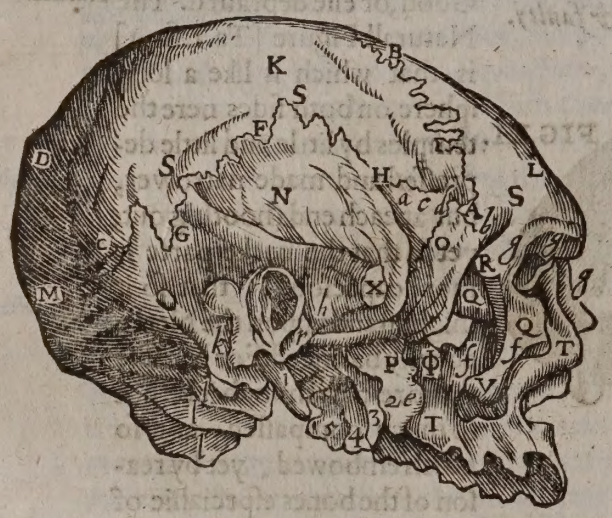
Figure 6. sheweth the left side.

Figure 7. sheweth the right side, the yoke-bone being remoued.

TABVLA. II.

FIG. VI.

VII.



AB, The Coronall suture.
CD, The Lambdal suture.
E, the Sagittall suture.
FGHΩ, the fourth proper circular suture.
IK, The bones of the *Sinciput*.
L, the forehead bone.
M, the *occiput* or nowle bone.
N, the bones of the Temples,
O, the wedge bone.
Φ 7, the fourth hole of the wedge bone in the orb of the eie.
P 7, Foure processes of the wedge bone marked with 2,3,4,5.
QQQ the first bone of the vpper iaw,
R, the prominence of this bone toward the temples,
SSS, A semicircle in the skull, from whence the temporal muscle doth arise.
TT, the fourth bone of the vpper iaw.
VX, the yoke bone.
Y, A suture in the yoke bone which some haue accounted for the fourth common suture.
Ω 6, *aa* 7, the forepart of the fourth proper suture.
b, the fift proper suture of the skull running obliquely from H to *g*.
c 7, A scale growing sometimes to the wedge-bone
d 7, A line distinguishing this scale from the bone
ee, the lower part of the second common suture at the sides of the pallat,
f 7, the first suture of the vpper iaw in the cheeke.
ggg, the first common suture in the side of the eie-brow,
b 7, A cauity of the temples made for the articulation of the lawer iaw,
i, the *appendix* of the temples called *Styloides*,
k, the mammillary processe of the temples,
l 7, the heads of the *occiput* or nowle bone where it is articulated with the first rack-bone,
m 6, A suture betwixt the bone of the iaw and the forehead,
n 6, The third bone of the vpper iaw.

[Table 1. figure 2.] wherein the eminence or out bearing before, shooting from the vpper part of the forehead is wanting, although the backward eminence in the nowle bee faire to be seene.

The second is quite contrary vnto this, in which [Table 1. figure 3.] the backward outshoote in the nowle is wanting but not that in the forehead.

The third [Table 1. figure 4.] in which both the eminences or out-shoots are wanting. There may bee another added to these three which many esteeme but onely imaginarie, and that is when the skull swelleth more in compasse toward each eare then it doth either forward or backward. But *Galen* in the place next aboue named saith and prooueth, or at least seemeth so to doe, that this is a meere speculatiue thing, but cannot be indeed in Nature, for then sayth he the fabricke of the braine must needes be ouerthrowne, yea it would proue a Monster and cannot liue. *Vesalius* is of opinion that *Hippocrates* maketh mention of this forme, and beside telleth a story of an Innocent as wee tearme them or foole in *Venice*, whose braine was of that shape; *Falopius* gain-sayes him, and auoucheth that *Hippocrates* made mention onely of three sortes, and that he mistooke the figure of the childs head at *Venice* of the same minde also is *Eustachius*.

Difference of Anatomists.

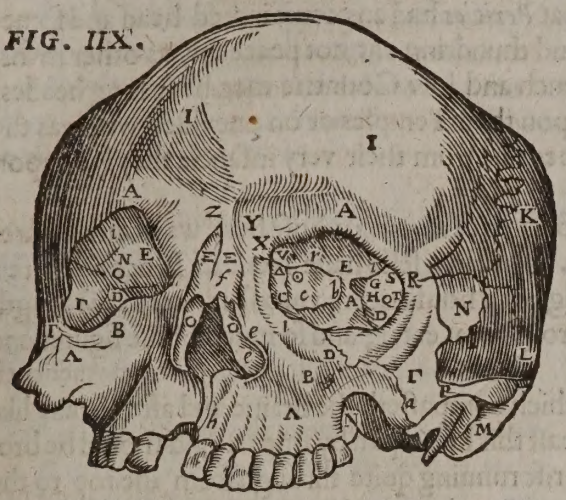
A fift Figure.

There may be a fift figure added out of *Hippocrates*, and that is an acuminated or sharp figure, wherein the left figure is but a little altered. This figure, sayeth hee in his booke *de aëre aquis et locis*, and the 35. Text, was first made by Art: for the Midwiues vsed to presse the

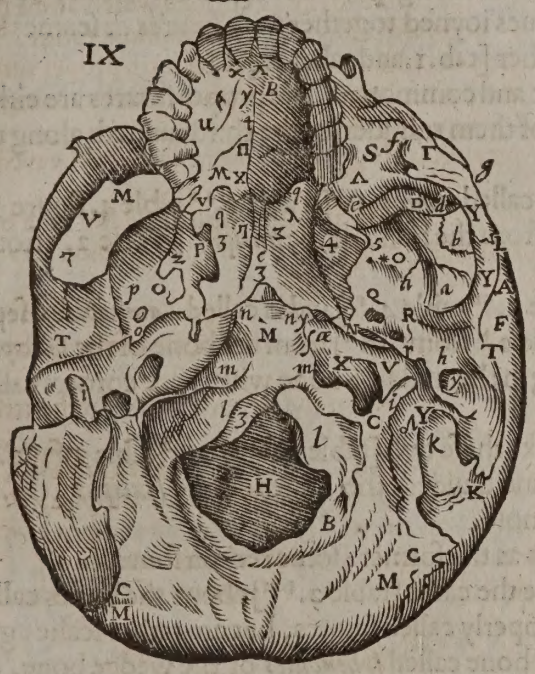
Table 3. Fig. 8. Sheweth the fore-side of the Skull, as also the bones, the holes or perforations and the Sutures both of the Skull and of the vpper Iaw.

TABVLA. III.

FIG. IIX.



IX



A A. A hole in the fore-head bone.
B B. The hole of the fourth bone of the vpper Iaw, which is in the Cheeke.
C. A hole of the second bone of the vpper Iaw in the inward angle of the eye.
D D. The fourth hole of the wedge-bone in the outward side of the eye.
E E. the first hole of the same bone,
G. the second hole.
H, the third hole of the same bone in the seate of the eye.
I I. the forehead bone.
K, the left bone of the *Sinciput*.
L, the left bone of the temples.
M. the mammillary processe of the temples.
N N, the wedge-bone.
Γ Γ Γ, the first bone of the vpper Iaw.
Δ, the second bone of the vpper Iaw,
Θ, the third.
ΛΛ, the fourth in the left eye.
Ξ Ξ, the fift bone of the vpper Iaw in the nose.
O O. the bridge or partition of the Nostrils.
P, the Suture in the yoke-bone.
Q, A part of the second common Suture from the first N, to S.
R S T V Y X Z. the third common Suture drawne obliquely through the Orbe of the eye.
a D, the first externall Suture of the vpper Iaw in the Cheeke, and from thence through the eye to Q.
b the third externall Suture of the vpper Iaw from *b* to *c*.
c, the second externall Suture of the vpper Iaw in the eye.
e, the fourth externall Suture reaching to Ξ.
f, the sixt externall Suture of the vpper Iaw in the middle of the Nose.
g, the second internall Suture in the Nose.
h, the seauenth externall Suture of the vpper Iaw.
i, A bastard Suture of the vpper Iaw at the eye,

Fig. 9, Sheweth the Basis of the Skull, and many holes and Sutures therein.

A, the end of the coronall Suture. C C, the lower additaments of the Lambdall Suture on either side. D, the fourth hole of the wedge-bone in the outside of the Orbe of the eye. F, A part of the fourth proper Suture. H, the great hole of the occipitium made for the Spinall marrow. K, A part of the bone called *Sinciput*. L L, A part of the forehead bone. M M, the lower part of the nowle bone. N, A tift or cleft of the wedge bone which is common to the bones of the temple, drawne on the left side from *n* to *o*. O O, the wedge bone. P, His foure processes marked 2,3,4,5, A R, the sixt hole of the wedge bone at the bottome of the throte, A, the seauenth hole of the same at R. Γ, the first bone of the vpper Iaw. S Λ, the fourth. Π, the sixt, where the cutter betwixt *c* and Π, hath not well expressed the Suture. T T, the bones of the temples on either side. V, the fourth hole of the bones of the temple made for the hearing. Σ, the bridge or partition of the nose. X, the first hole of the temple bone in his Basis. Y Y, the yoke bone. *a a*, the anterior part of the fourth proper Suture. *b*, the lower part of the fift proper oblique Suture, *c*, the lower part of the bridge of the nose which is like a coulter where 3 is placed, *d* the vpper part of the second common Suture. *f*, the first externall Suture of the vpper Iaw in the Cheeke. *g*, the first common Suture in the side of the brow. *h*, the cauity of the temples whereto the lower Iaw is articulated, *i i*, the appendix of the temple bone called *Styloides*. *k* the mammillary processe of the same temples. *l l*, the knub of the nowle bone, *m m*, the 6 proper oblique Suture of the Skull, *n n*, the 7 trãsuerse Suture, *o p*, A line beginning from the last named Suture which climeth by the temples, & is more like a diuision then a line. *q q*, the lower part of the 2 commõ Suture of the Skull in the hollownes of the nose, *r*, the line of the hole of hearing, *s ε*, the stony bones, *t v*, the 5 externall transuerse Suture of the vpper Iaw, *X y*, the 7 externall right Suture, *α β*, A bastard Suture of the vpper Iaw in the Pallate, *γ*, the hole of the eare, *δ*, the 5 hole of the temples neere vnto his processe where Y should be blotted out, B, A hole of the nowle bone which is not alwayes found, E, the 2 hole of the nowle bone made for the 6 coniugation of the sinewes & for the iugular veine & artery, H, the 1 hole of the occipitium or nowle bone for the passage of the marrow, 3, the 3 hole for the outgate of the 7 coniugation, *κ λ*, two holes of the nose, *μ ν*, two holes in the Pallate which is accounted the 4 of the wedge-bone, *ξ*, Fiue holes in the basis of the wedge-bone, *π*, the hole of the 4 bone of the vpper Iaw in the Pallate. Note that M, V, at the right side pointeth out the cauity which the yoke bone maketh for the passage of the temporall muscles.

the heads of Infants lightly on euery ſide to make them riſe ſomewhat toward the crowne, and after ſo rowled it with bands till that forme was confirmed; the reaſon was ſaith *Hippo.* becauſe the people had an opinion that it was a ſigne of a generous & noble diſpoſition to be ſo featured; afterward Nature imitated Art and children were ſo borne; *Quintilian* in his ſecond Booke and 17. Chapter, ſaith that *Pericles* had an accuminated head and ſomewhat long, and his words came thronging and thundring out, not peaceably as other mens; ſo we ſee, ſaith *Bauhine*, that moſt of the French and low Countrie men haue long heades, becauſe they vſe to lie with their heades vppon their Temples or on one ſide: whereas the Germanes haue moſt what round heads, becauſe from their very infancie they lye vppon their backes.

A ſixt. Finally, *Veſalius* maketh mention of a begger of *Bononia* whoſe head was foure ſquare, ſauing that it was a little broader then long. And my ſelfe haue ſeene in Lincolneſhire a wondrous ſmall head made very like the ridge of a houſe neere vnto ſharpnes al the length through, that boy was a foole and a wondrous great eater; and ſo much of the figures and faſhions of the head.

A ſeauenth ſeene in Lincolnſhire.

The skull. The skull or *cranium* is all that bone which compaſſeth the braine and after-brain like a helmet, which is not made of one bone, leaſt this brain-pan by one wound ſhould be broken throughout, as we ſee a pot will be, the rift running quite through from the top to the bottome. It is made therefore of many bones ioyned together with ſutures or ſeames like the teeth of two ſawes ſet one againſt the other [tab. 1. and tab. 5. fig. 13.]

Proper ſutures. Theſe ſutures are of two ſortes, proper and common. The proper ſutures are either *true* or *falſe*, the true ſutures are three, two of them tranſuerſe, the third runneth along the head.

True. The firſt is that which is in the forepart called *Coronalis* [Table 2.$^{A\,B}$ table 4. figure 11.^{nn}] and diſtinguiſheth the forehead bone from the bone of the *ſinciput* [Table 2.^{L} from ^{I} to ^{K}.]

The ſecond ſuture is in the nowle [table 2.^{CD} table 4.^{PP}] and is called *Lambdoides* ſeparating the bone of the nowle or *occiput* [table 2.^{M} from ^{I} to ^{K}] from the bone of the *ſynciput*: this ſuture is ſometimes double, containing in the middle a bone with three corners called *Triangulareos*.

The third ſuture is in the middeſt betwixt theſe two [table 2. figure 1.^{Z} table 9. fig. 2.^{oo}] and is called *ſagittalis*, it is a ſtraight ſeame and diuideth the bones of the *ſynciput* [tab. 2. fig. 6.^{IK}] deſcending ſometimes euen to the noſe.

False ſutures. The falſe ſutures are not ſo conſpicuous as the former; ſome reckon foure.

The firſt are two, on either ſide one aboue the eares [table 2.^{FGH}] aboue the bones called *petroſa* or the rockie bones. They are not properly called ſutures, but are rather ſcalie aglutinations. The ſecond two belong to the bone called *ſphenoides* or the wedge bone, on the forepart and the hindpart.

Common ſutures fiue. The common ſutures are thoſe that belong as well to the skull as to the vpper iaw, and they are fiue. The firſt is in the outſide of the brow. [table 2. figure 6. and 7.^{gg} table 3. fig 8.^{R} figure 9.^{g}.] The ſecond is double, the vppermoſt is in the outſide of the eye & the hollow part of the Temples [table 3. figure 8. from ^{f} to ^{e} at figure 9. at ^{d} table 2. figure 7. at ^{d}] The lowerwoſt is at the ſides of the pallat. [table 3. figure 9. from ^{d} to ^{c}] The third is in the inner and laterall part of the eye. [table 3. figure 8.^{RSTVXYZ}]

The fourth runneth through the middeſt of the iugall bone [table 2. figure 6.^{Y} table 3. fig. 9.^{Y} fig. 8.^{P}.]

The fift is in the bredth of the noſe and is common [tab. 3. fig. 9. vnder z.] to the *ſphenoides*, or wedgebone and the bridge of the noſe.

The vſes of the ſutures. The vſe of the ſutures is to giue way to the thicke and ſooty excrements; againe to tye the *dura meninx* to the skull, and to giue way for the filaments of the ſame which make the *Pericranium* and *Perioſtium* as is ſayed; and finally to giue ingate and outgate to the veſſelles.

Beſide the ſutures, the skull it ſelfe is graſſe; rare and full of holes.

The ſubſtãce of the skul. Graſſe or thicke for the ſecurity of that therein contained.

Rare that it might not be too great a burthen; and full of holes [tab. 4. fig. 11. 12.^{L} tab. 5. fig. 14.^{c}] to giue way to the tranſpiration of ſooty excrements.

His tables. It is alſo made of a double table as we call it, or of two leaues [table 5. fig. 14.^{aa}] which may beſt be diſtinguiſhed about the place of the browes, the outward of theſe may bee eaten

ten away by the French diſeaſe, the inner remaining ſound.

Betwixt theſe Tables are conueyed Veines and Arteries for the life and nouriſhment of the ſcull, among which veſſels there is a kinde of medullous or marrowy ſubſtance [tab 5. fig. 14. betwixt [a] and [o] [c]] which ſome call *Meditullium.* *Meditullium.*

Theſe Tables are oftentimes perforated in many places but without order, thorough which perforations ſmall veſſelles paſſe into the inward Cauity euen to the *dura Meninx.* His perforations.

On the outſide the ſcull is ſmooth, but if you turne the bottome vpwarde it is full of inæqualities and protuberations. Of all which we ſhall entreate more at large in our book of bones.

CHAP. V. *Of the bones proper to the Scull.*

THE bones of the head are of two ſorts, ſome are proper to the ſcul alone, ſome belong to the vpper iaw alſo. The bones proper to the ſcul alone are ſix in number (for wee goe not now preciſely to worke to account the ſmall bones of the eares) thoſe of the Iaw two. The proper bones of the Head.

Tab. 4. Fig. 10. ſheweth the inner and lower part of the ſcal, together with many holes eſpecially thoſe of the Wedge-bone. Figure 11. ſheweth the vpper part of the inſide of the ſcull cut from the Lower.

TABLVA IIII.

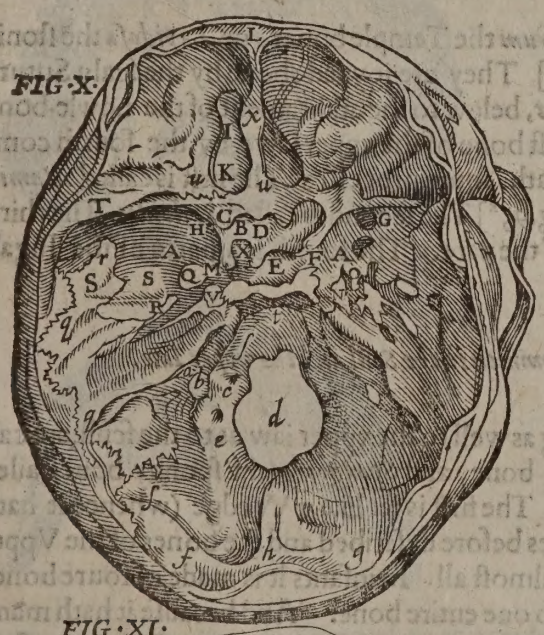


FIG. X.

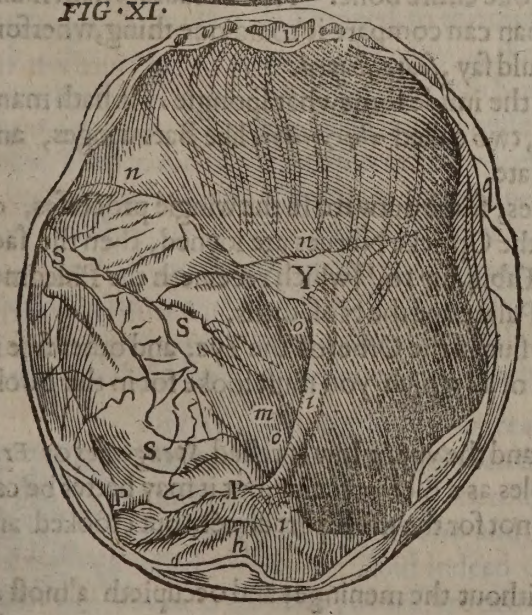


FIG. XI.

A, The Wedge-bone. B, his firſt hole.
C, the corner of that hole.
D, the *anterior* tranſuerſe cauities of this bone in which the Optick nerues are hidden.
E, The latter of theſe foureſquare wherein the pituitarie Glandule lyeth.
F, The forward paſſage through which the Flegme gathered together is deriued.
G, The ſecond hole of the Wedge-bone in the vpper part of the orbe of the eye.
H, the third in the bottome of the eye.
I, the ſmall holes of the ſpongy bone.
K, A cleft of this bone through which the *dura meninx* is tied. L 10, 11, the cauity of the for-head bone betwixt the two Tables. (foration.
M, the Wedge-bone in this place hath oftentimes a per-
N, A cleft or ſlit common to the Wedge-bone & bones of the Temples.
O, the laſt of the Wedge-bone. Q, the ſixt hole.
R, the 7 hole in the chops at the bottome of the throate.
SS, 10, 11 and T, Certain inſcriptions or furrowes in the ſcull, impreſſed by the veines of the *Dura Meninx.*
V, the eight hole of the Wedgebone at the noſtrils.
X, The fift hole of the ſame bone. Y, 11, the Fontanell
ZZ A cauity made for the forwarde extuberations of the braine.
a The ſixt hole of the Temple-bones, which is the fourth for the hearing.
b, The ſecond hole of the nowle-bone.
c The third, *d* the firſt, *e* the ſecond,
f, *g*, the two *Poſterior* cauities of the ſcull.
h, 10, 11, the extreamity or ende of the third and middle cauity.
i i, 11, A Boſome of this paſſage running thorough the length of the ſcull,
i, 10, A boſome common with the nowle bone,
m, 11, Certaine ſmall holes in the inſide of the bone of the *ſynciput.* *n*, *n*, 11, the Coronal ſuture.
o o, 11, The ſagittall ſuture. *pp*, 11. the Lambdal ſuture.
qq, 10, 11. The 4 ſuture called *Squami-formis.*
rr, The forepart of this ſuture compaſsing ſome part of the wedge-bone.
ſ, A part of the Lambdall ſuture, which ſome call the *6.* proper ſuture.
t, A line that ioyneth the ends of the Lambdal ſuture, called by others the 7 proper tranſuerſe oblique ſuture.
u, *u*. The eight proper tranſuerſe ſuture.
x, The bridge or partition of the ſpongie bone.
aa. The proceſſes of the Wedge-bone called *Clinoides.*

The

The forhead bone.

The first bone of the scull is called *Os Frontis* the fore-head bone: [Tab.2,fig.6,7.[L] Tab. 3,fig.8.[I I]] it is circumscribed with the Coronall suture, [Tab.2,fig.6,[C] fig.7,[A B]] and that which is common to the head and the vpper iaw. [Tab.3,fig.8,[K]. Table 2. fig. 6, and 7,[E]] In this bone on either side the browes [Tab,4.fig.10 & 11 at [L]] there is a notable bosome or hollownesse, wherein is conteyned a soft and medullous matter, or haply it was framed to contein aer for the sense of smelling. It hath two processes, the one reaching toward the lesse, the other toward the greater angle of the eie, & make the vpper part of the orb thereof. The second and third are called *Ossa Syncipitis*, [Tab.2 fig.6,[I K]] they are full of dens or small holes on the inside with many inscriptions like the path of a snaile or Emmet [Tab.4 fig 10 and 11 SS] where the vessels runne. They are foure square, of substance in respect of the rest very thin and weak. They are limited backward by the Lambdal Suture [Tab.2.fig 6,[D C]] forward by the Coronall [Tab.2,fig.6,[A B]] and below by the scalie Sutures of the Temple-bones. [Tab.2.fig.6,[G F K]]

the side bones *Ossa Syncipitis*.

The Noddle bone.

The fourth is called *Os Occipitis* the Noddle or Nowle-bone. [Tab.2,fig.6 and 7[M]. Tab.3, fig.9[MM]] It is ioyned aboue to the bones of the *Synciput* [Tab.2,fig.6.[I K]] by the Labdall suture; [Tab.2,figure 6,[C D]] at the sides to the Temple-bones, [Tab.3,fig. 9, in [C]] in the middest to the wedge bone. [Tab.3,figure 9, O O] The figure of it is almost rounde, the substance is very thicke and hard, yet but thin and weake at the side of the great hole made in it. [Tab.3,fig.9.[M] Tab.4.fig.10,[d]] through which the marrow entreth into the rack-bones of the necke. It hath nine bosomes or hollownesses. On the inside seauen, on the outside two. Fiues holes or outlets; and lastly two processes or heads [Tab.3,fig.9,[I I]] broad, couered with a Cartilage or Gristle which are inserted into the cauities of the first rack-bone of the neck vpon which the head is mooued. Backward it hath a small processe like a tooth which is receiued by the first racke-bone.

The temple bones.

The fift and the sixt are called *Ossa temporum* the Temple bones, or *Lapidosa* the stonie bones. [Tab.2. fig.6. and 7[N]. Tab.3 fig.9[TT]] They are ioyned aboue by the scaly Suture [Tab.2,fig.6,7[E G H]] to the bones of *Synciput*, below to the additament of the nowle-bone by the sixt suture, [Tab.3.fig.9[m n]] to the first bone of the vpper iawe by the fourth common suture. [Tab.2,fig.6[Y]] Each of these hath foure processes. The first is called *Mamillaris*. [Tab.2,fig.6 and 7[K]. Tab.5.fig.8[M]. Fig.9,[K]] The second is called *Styloides*. The third *Labyrinthus*, conteyning the small bones of the eare. The fourth is a parte of the Iugall bone.

CHAP. VI. *Of the two Bones common to the Scul and the vpper Iaw.*

The Wedge-bone.

THE two Bones which belong as well to the vpper iaw as to the scull, are called *Sphenoides* or the Wedge-bone, and *Spongoides* the spongy bone called also *Cribriforme* or *Ethmoides*. The first is set like a Wedge (whence it hath his name) betwixte the bones before described and the bones of the Vpper iaw, so that it toucheth them almost all. In infants it is made of foure bones but after we are growne it also groweth into one entire bone. And because it hath many processes and inequalities on both sides, a man can compare it to no one thing, wherfore the Ancients called it πολύμορφον, as if we should say, *seare shaped*.

The substance of it is fast and strong, but the inside somewhat spongie. It hath many processes, two on the inside called κληνοειδεῖς, two called πτερυγοειδεῖς like Bats winges, and foure small ones which make the *saddle* or seate.

It hath also many hollownesses or bosomes, some outward in the wingie processes, others inward, in which [Tab.4.fig.10,at C] the Opticke Nerues are ioyned, then the saddle it selfe wherein is the Glandule placed [Tab.4.fig.10,[r]] which receiueth the Phlegme, from whence afterward it floweth into the Palate and the Nose thrils.

It hath also many cauities and ten holes, fiue in the Orbe of the eye, and other fiue in the basis of the Scull. The exact description of all which you must looke for in the booke of Bones.

The Spongie bone.

The second bone common to the Skull and the vpper Iaw is called *Spongoides* or *Ethmoides* Cribre forme; because it is full of holes as a Siue or searce, but it may better be called the spongy bone, because the holes are not for the most part direct, but crooked and oblique like the pores of a sponge.

It is placed in the forepart of the Skull without the meninges and occupieth almost all the

Tab.5.Fig.12.sheweth the inside of the wedg and spongy bones. Fig.13. Two portions of the bones of the Sinciput a little disioyned the one from the other, that the frame of the Suture might be better perceiued. Fig. 14. sheweth a part of the bone sinciput diuided with a saw from the rest of the same bone, the better to exhibite the substance of the Scull.

TABVLA. V.

FIG XII

XIII

XIV.

A A. The spongy or the eight bone.
B. A bridge or partition diuiding the Organes of smelling.
C.D. Two cauities of the wedge bone.
E. A partition distinguishing them asunder.
F. A hole of one of the Cauities ending in the Nostrils.
G. A right Cauity scituated vnder the two former.
H H. Processes like to Bats wings.
a o 14. The vppper or exterior Table *a*, the interiour *o*.
c 14. A cauernouse or spongy substance in the middest betwixt them called *Diploïs*.

the cauity of the nose; it is ioyned to the middest of the bottome of the forehead bone, [Tab.4,fig.10,^{k}] and is distinguished from the wedge bone by a bastard seame called a Harmony, which is accounted for the ninth Suture. [Tab.4,fig.10,aboue^{n}] There are foure parts of this bone. The first is an vpper processe in themidst, long & triangular like a Cocks combe. The second is on both sides that processe [Tab.4,fig.10^{xx}. Tab.5,fig.12,^{AA}] which is couered with a thinne Membrane likewise perforated. The third is a lower processe opposite to the vpper which diuideth the vpper part of the nose into two parts. The fourth part is the substance it selfe of the *sponge* from whence it hath his name. The vse of it is to admit aer for the generation of Animall spirits, to admit vapours to the sense of smelling; but the pores of it are not direct but oblique and crooked least the cold ayer should too directly ascend vnto the braine to refrigerate or coole it ouermuch. The vse of it.

CHAP. VII. *Of the Meninges or Membranes of the Braine.*

AS the lower belly and parts therein are compassed with the *Peritonæum*, & the middle with the *Pleura*, so there are two membranes stretched ouer the cauity of the Skull, which *Galen* and those who haue written since his time haue called μηνίγγας. And indeed *Galen* had the name out of *Hippocrates* his book *de Carnibus*, who there taketh it in a larger signification, which giueth *Galen.* *Hippocrates.*

that

that name to all parts that are hollow, as the veines, the ſtomacke the guts and ſuch like. *Eraſiſtratus* called theſe membranes ἐπικρανίδας, *Pollux* εἰλαμίδες. The *Arabians* called them *Matres* the Mothers, and ſo now they are commonly tearmed. *Macrobius* calleth them Omenta or kelles. The one of theſe which is the outward is thicke and called *dura mater* the hard Mother, the other inward and thinne called *Pia mater*, the deere or neere Mother, becauſe it immediately incompaſſeth and imbraceth the ſubſtance of the braine.

Their names.

The *dura mater.*

The thicke *meninx Hippocrates* (in his booke *de locis in homine*) calleth παχυῖτιν. *Galen* σκληρὰ or παχεῖα or δερματώδης μῆνιγξ, that is, the thicke hard or skinny *meninx*, commonly the *dura mater*, becauſe of all the membranes of the body it is the thickeſt, hardeſt and ſtrongeſt, and particularly in relation to the thinner *meninx*.

In figure and magnitude this membrane anſwereth the bones of the Scull, becauſe it incompaſſeth all his boſomes and cauities. It is greater then the *Pia mater* or thinner *meninx* leaſt if it lay to cloſe vnto it the veſſels that run therin ſhould be compreſſed, which if they be diſtended and ſwell too full of bloud, do cauſe the head-ach yea oftentimes the Apoplexie; whence it is that many which dye of the Apoplexie, auoid bloud out of their noſe and their mouth.

His figure & magnitude.

It is tyed very ſtrongly to the Baſis of the Scull and to his ſharper proceſſes, and to the orbes or circles of his holes, [Tab.11, fig.7, zz] whereupon ſome haue thought that from this Baſis it tooke his originall, becauſe ſeede is the matter *out of which* this, as all other membranes are made. Notwithſtanding it cleaueth not ſo cloſe to that boſome of the wedge bone [Tab.4, fig.10ᵗ,] where the Glandule of phelgme is ſcituated, [Tab.7, fig. 15, ^] nor yet at the ſides thereof where thoſe boſomes are which giue way to the branches of the ſleepy arteries called *Carotides*. It incompaſſeth all the inſide of the Scull, from which as alſo from the braine it hangeth in the like diſtance as doth the *Pericardiũ* or purſe from the heart, leaſt the eleuation and depreſsion, or the *Syſtole and Dyaſtole* of the braine ſhould be hindred. I know full well (that we may ſay ſomething of it by the way) that *Platerus* thought that the braine it ſelfe did not moue, but that it was onely the pulſation of the third ventricle much like the beating of an artery, which we feele in the Sculs of tender Infants before their bones are ioyned cloſe together. But *Columbus* and *Archangelus* doe demonſtrate a manifeſt *Syſtole* and *Dyaſtole* of the braine from their experience in thoſe whoſe Sculs are wounded and the bones taken out with a Trepan. And *Laurentius* thinketh him not worthy the name of an Anatomiſt that will call it into queſtion.

Connexion.

Whether the braine mooue or no. *Platerus.* *Columbus. Archangelus. Laurentius.*

It is tied very ſtrongly to the Scull by thinne and membranous fibres (which *Galen* in the 8. booke of the vſe of parts and the 9. chapter calleth Ligaments) ariſing there-from, which paſſe through the Sutures of the Scull, eſpecially about the Lambdal Suture, euery one of which Ligaments or fibrous ties chuſe you whether, are extended ouer the part of the Scull where againſt they iſſue, and running along are exactly vnited together & make that common Membrane which we ſaide before was called *Pericranium*, vnder which there is yet another farre finer and thinner called *Perioſtium*; from which two membranes all the other membranes of the body haue their origninall, that in this reſpect this *Dura meninx* may well be called *Mater*, as being the Mother of all other membranes. It is alſo knit to the *Pia mater* and to the braine by the mediation of veſſels. [Tab. 6, fig.2, ᴰᴰ ᴳᴳ. Tab. 11, fig.8, ˣˣ.]

This membrane is double as are the reſt of the membranes of the body; and *Columbus* makes two membranes of it, one inward another outward, and boaſts himſelfe of the finding of them: whom *Laurentius* cloſely taxeth confeſsing that it is indeed double, but they are not therfore to be called two membranes; ſo ſaith he, we do not ſay that there are two rims of the belly, and yet we know that the *Peritonæum* is double. Well, it hath a double ſuperficies or ſurface; the outward like a broad Tendon is ſtretched ouer the other and groweth vnto it; hard it is and rough, partly by reaſon of the fibres which if you take away a piece of the Scull you may perceiue a little to ſwell vp like a ſmall line, [Tab. 6, fig. 1, ᵍᵍᵍ. ᴴᴴ.ᴵᴵ.] partly becauſe in the crowne of the head where the ſagitall Suture meeteth with the Coronall, there are certaine ſmal knubs or knots, which in the Scull haue their proper boſomes wherein they couch and to which they grow very faſt. [Tab.6, fig.1, ˣ.]

It is double but not two.

The inner ſuperficies or ſurface is bright, ſmooth, ſlippery and much whiter without any ſuch knubby or kernelly ſubſtance or fat (what you will call it) at all; moiſtened alſo with a watery humor, [tab.6, fig.2, ᴴᴴ] whereas the vtter is dryer. On the inſide alſo it is of exquiſite ſenſe, but on the outſide not ſo that it might better endure the contaction of the

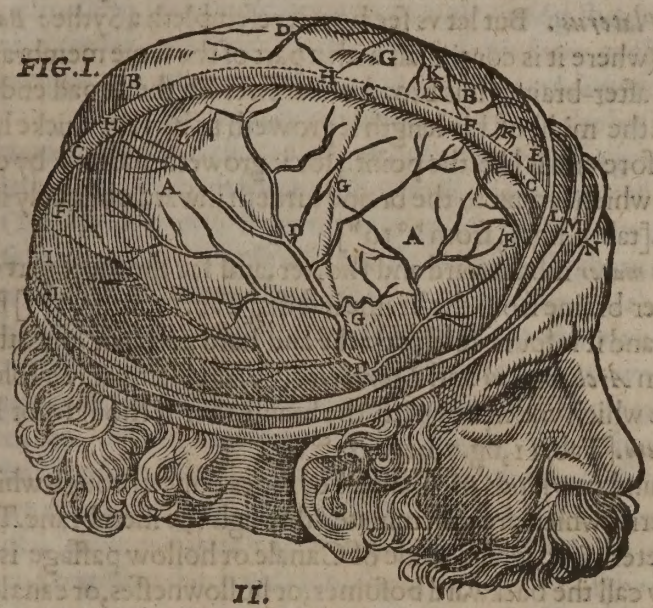
bone

Tab.6. Fig.1. sheweth a head, the Scull being taken away that so the braine may appeare as it is couered with the Dura meninx.

Fig.2. sheweth the Braine cleared from the Dura meninx, together with the third Sinus thereof, diuided through the middest, which is shewed couered with the Pia mater.

TABVLA. VI.

FIG. I.



II.

AA. BB. The *Dura meninx* or thicke membrane.

CCC. The third *Sinus* of this membrane.

DD, The course of the veines as they run through the membrane, or the second veine of the braine.

EE, The fift veine of the braine.

FFF, Certaine small veines which perforate the Scull and reach to the *pericranium* or Scull-skin.

GGG. Fibres of the *Dura meninx* passing through the Coronall Suture which fibres make the *Pericranium*.

HH. Fibres passing through the sagittall Suture.

II. Others passing through the Lambdall Suture.

K. A knub which vseth to grow to the *Sinus* of the Scull.

L. A cauity in the forehead bone.

M. The Scull.

N. The *Pericranium* or Scull-skinne.

Fig.2.

AAA. A part of the *Crasse meninx* diuiding the braine.

BB. the third *Sinus* of the same *Crasse* membrane opened.

CC. the beginnings of the vessels out of the third *Sinus* into the *Pia mater*.

DDD. the propagation or branching of these vessels.

EEE. the *Pia mater* or thin *meninx* immediately compassing the braine.

FFF. Certaine vessels running through the conuolutions or breaches of the braine.

GGG. Certaine branches of veines running through the sides of the *dura meninx*.

HHH. The thicke membrane reflected downeward.

bone without offence.

It hath many holes or passages in it, first of all (saith *Galen* in his 9. booke of the *vse of parts*, and the 6. chapter; to giue way to many veines; againe, for the outgate of the Conjugations or paires of the sinewes. Moreouer in the middest it hath one notable perforation and that round, to let out the braine Tunnell, called *Infundibulum*, [tab.12, fig. 11, F] as also others at the sides of the former to admit the sleepy arteries called *Carotides*, [Tab. 12, fig. 11, C and D] and one larger then all the rest through which the marrow of the backe descendeth out of the braine. [Tab.12, fig.9, N] Finally, where it is stretched ouer the spongy bone, it is perforated manifold like a Siue. [Tab.14, figure 18, at F and figure 9, at FF] His holes or passages.

In the top of the head it is redoubled and separateth the braine into two parts, a right and a left, euen as low as the center thereof. [Tab.10, fig. 13, from D to B] Which Redu- His Redupli- cation.

plication lyeth all along the third bosome or *Sinus* of this hard membrane & runneth with the bosome through the length of the head forward vnto the top of the nose, and groweth fast vnto the distinction of the mamillary processes, [Tab.9,fig.3,N] euen as it groweth backward in the middest to the hinder processe.

The Sythe. This Reduplication of the *dura meninx* is called the vpper processe and is likened by all the best Anatomists to a Mowers Sythe; and *Laurentius* is not affraide to call it *Falx* or the Sythe, and saith that this reduplication makes the body of the same: but *Vesalius* saith that the processe which is like a Sythe is not duplicated but simple as the membrane it selfe is simple, and seemeth onely to be double because of the bosome which parteth the braine; of the same minde also is *Platerus*. But let vs see how it resembleth a Sythe: *Bauhine* fashioneth it thus. Backward, (where it is continuall with a part of the same membrane which couereth the *Cerebellum* or after-braine) it is broad and answereth the broad end of the Sythe, [tab.9,fig.3,at P] about the midst of his length it groweth to be very thicke like the backe of the Sythe, and the fore end is like the point; for it groweth narrow by degrees and therefore that part of it which is next to the braine turneth inward obliquely iust like the hooking point of a Sythe. [tab.9,fig.3, from F,G to H]

The other processe of the *Dura mater* is backward and shorter, and for the most part distinguisheth the *Cerebellum* or after-braine from the braine it selfe, [Tab.11,fig.7, oooo] Beside it couereth the *Cerebellum*, and it is foure-fold as thicke and hard as it is in any other place saith *Columbus* and with him *Archangelus* and *Laurentius*, *Vesalius* saith three-folde. Dogges in this place haue a bone which vnderproppeth the braine that it should not lye heauy or beare vpon the *Cerebellum*. [Tab.11,fig.7, betwixt oo and xx]

The other processe of the *Dura Meninx*.

A bone in Dogges.

Two kinds of Cauities. In this membrane there are found two kinds of Canales or pipes; one through which the vessels are carried, as the Arteries which are disseminated through the membrane. The other into which the veines do determine, which kinde of Canale or hollow passage is to it instead of veines; and these they call the backward bosomes, or hollownesses, or canales, (for other words to expresse a *Sinus* I cannot deuise) of which wee will immediately intreate.

Fallopius his ten *Sinus*. *Fallopius* in his obseruations reckoneth ten of these *Sinus*, on either side foure; the ninth is that which other Anatomists take for the third, & the tenth that they take for the fourth; but in his institutions he reckoneth but sixe: foure of which we know well, the other two saith *Bauhine*, I thinke no man knowes but himselfe.

Foure *Sinus* of the *Dura mater*. We with *Bauhine* (whom for the most part we follow) do reckon foure, which *Galen* in the ninth booke *de Anatomicis Administrationibus* called διπλόαι in the 9. booke *de vsu part.* and the 6. chap. sometimes *meningis* διπλώσεις leading bloud: sometimes τῆς παχείας μηνίγγος κοιλίαι the ventricles of the thicke membrane; as in his 9. booke *de Anatomicis Administrationibus* and the first chapter, because they arise from the duplication of the membrane, and are as it were Rillets carrying bloud and spirits. And haply hence tooke *Pelops* the occasion of his error, who auouched that all the vessels had their originall from the head.

Pelops his error whence.

The two first *Sinus*. The two first Sinus, or Canels, or Rillets, (call them as you please) haue their beginning behind in the Basis of the *Occipitium* or nowle betwixt the braine and the after-braine at the sides of the hole through which the marrow of the backe descendeth: they are one on each side, [Tab.7,fig.13,M N] called the right and the left. They lye neere the sides of the Lābdall Suture, and into them do the veines and the arteries exonerate & vnburden themselues. They are fastened to the Scull, and when they come neere the middle of the Lābdall Suture & the top of the *Cerebellum*, they ioyne in one and make a common cauity, which place [Tab.7,fig.13,°] *Herophylus* (saith *Galen* in his 9. book of the vse of parts and the 6. chapter, and in the 9. of his Anatomicall Administrations and the first) called ληνὸν that is, *Torcular* the *Presse*, because from thence as from a high place the Rils runne downe on eyther side; some of them out of the middest of it are deriued into the whole after-braine, others run from the forepart, from whence, as wine from a grape-presse, the bloud poured out of the veines and arteries is squeesed into the whole braine. From these on eyther hand at the sides runne small branches like veines, some of them as small as a very haire, some of them larger, [Tab.7,fig.13,ss] which runne out into the bordering mēbranes, both the thicke one [Tab.11,fig.7,ooo] and the thin one [Tab.12,fig.9,B D] where they couer the whole *Cerebellum*.

Galen.

The Presse of the braine.

Out of the concurrence of these [Tab.7,fig.13,°] do arise two other *Sinus* or Rils differing in length and in the fashion of their cauities. The one of them is the higher and is called

called the third *Sinus* [Table 15. figure 13.[pp]] the other lower called the fourth [table 7. fig. 13.[n]].

The third *Sinus* which is like a Rill of bloud, called sometimes by *Galen* a veine and not vnproperly (for what should you call a vessell in which bloud is contained but a veine though it haue not the coate of a veine) though some thinke it to be *Herophilus* his *presse* of which we spake euen now; it passeth directly forward through the length of the head [table 6. fig. 1. and 2. ccc] betwixt the right and the left parts of the Braine vnder the vpper part of the Lambdall Suture and vnder the Sagitall Suture, and vnder the middest of the forehead bone in the top of the nose is ioyned to the bony partition [tab. 7. fig. 13.[o]] of the organs of smelling, and would be like a triangle, sauing that in the vpper part it is some what neere to a *semicircular* form: for the cauity of this *Sinus*, as also of the two former, haue two crooked ribs as it were inward, and the third curued outward. The third.

From this *Sinus* or canale on either side the braine all along the head there arise very thicke certaine vessels as it were branches out of a great trunke of a veine which *Galen* calleth ὀχεῖας, of which some are but small which they call *venas reptitias*, the creeping veines. Of these some arise from the higher part of the *Sinus*, some from the lower, some from the sides thereof. Those which arise out of the higher part [Table 7. figure 13. x x x] which is next the skull, do run vpward to the duplication of the skull, that is to the porie substance between the tables thereof, and to the *Pericranium*, and mingle themselues with those small vessells which descend from the skinne of the crowne and passe through the skull at small pores thrilled therein for the same purpose. Those which arise from the lower part of the canale, that is, which is next the braine [table 7. figure 13. v v v table 9. figure 3.[ff, hh]] are but small, and runne downeward onely into that part of the *dura meninx* which euen nowe we called the *sithe*. Those which arise out of the sides of the *Sinus*, that is out of the bredth of it [table 7. figure 13.[ttt] tab. 8. figure 2.[ddfff]] are infinitely diuersified into the *pia mater* and together therewith into the conuolutions of the brain; and where the *pia mater* endeth they proceed on into the very substance it selfe of the braine. These vessels sometimes opening, so great a quantity of bloud hath issued by the Nosethrils, that it is credibly reported to haue amounted to 24. pound: in which kinde of fluxe wee must not apply medicines to the forehead, but either to the crowne or to the coronall suture. Branches frō the 3. Sinus. Great quantity of bloud out of the nose whence it comes.

Columbus was of opinion that these vessels do not arise out of the *Sinus* it selfe, but out of the veines running therin, for he thought that the internal iugular veines passed through it. *Archangelus* also seemeth to incline this way, who sayth that through the two former *Sinus* or rils, the inner iugular veines and arteries doe passe and insinuate themselues into the third *Sinus* and so run out to the nose, yea backward also to the fourth *Sinus* and quite through it. *Columbus Archangelus.*

The fourth *Sinus* sayth *Vesalius* the professors of dissection haue not remembred. It is no where neare vnto the skull as the others are, but seated in the lower part of the braine: very short it is and runneth directly betwixt the brayne and the after-brayne to that part of the braine called *Nates* or the bottocks; and the glandule called *pinealis* (for such representations there are in the substance of the braine [table 7. figure 13.[a] table 11. figure 7.[r]] and the cauity of it is like a triangle made of three equall ribs curued inward. The beginning of this cautiy, or rather trueth to say the meeting of all foure [Tab. 7. fig. 13.[o]] some call the *Torcular* or the presse; and from hence do spring the veines, sayth *Columbus* and with him *Bauhine*, which are dispersed through the substance of the braine to nourish it. The fourth.

From this *Sinus* also in his progresse doe issue small branches, some of which runne vpward to that part of the *dura mater* which is aboue the *Cerebellum* and as far as to the *sithe*, [table 7. figure 13.[yy]] others downward [tab. 7. fig. 13.[aa]] which are dispersed into the *dura mater*, where it lyeth aboue the after-brain, as also into the *pia mater*, both where it compasseth the after-braine and the braine it selfe. Branches frō the 4. Sinus. The vpper.

Afterward this *Sinus* is deuided into diuers rillets; two issue out of the vpper part of it and one out of the lower; of the two which issue out of the vpper part, one is greater another lesse.

The greater [table 7. figure 13.[b]] creepeth along the lower part of the *dura meninx* where it deuideth the braine in his length; from which certaine furcles runne [Table 7. fig. 13.[ccc]] vpward to the processe of the same *dura mater*.

The lesser which is double, a right and a left [table 7. figure 13.[de] table 3. figure 3.[ii ee gg]] supported with the thinne membrane after the manner of veines are ledde through the

length of the braine on either side aboue the callous body called *Corpus calosum*, and afford some small twigs to the *piamater* which are distributed on either side into the braine.

The lower rillet [table 7. figure 13.f] is but one propagated into that part of the *pia mater* which compasseth the *Cerebellum*; but it is diuided into two branches, one of them run-

Table. 7. Figure 13. *exhibiteth the vessells of the Braine and their distribution, especially through the right side, whither they proceede from the internall Iugular veine, or from the sleepie Arterie, or from the* sinus *of the* Dura Meninx.

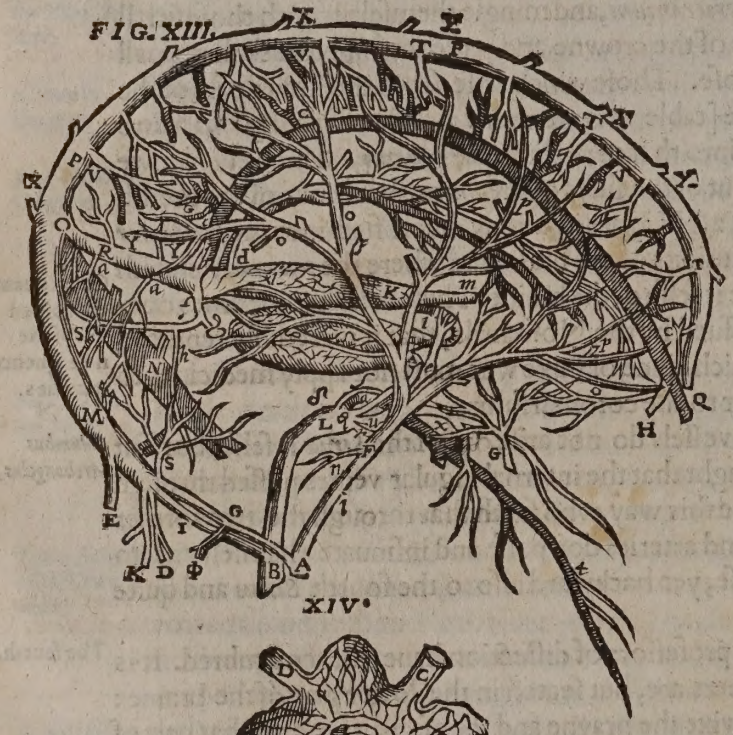
Figure, 14. *sheweth the wonderful Net as Galen describeth it.*

Figure 15. *sheweth the pituitary Glandule with the Bason and the sleepy Arteries.*

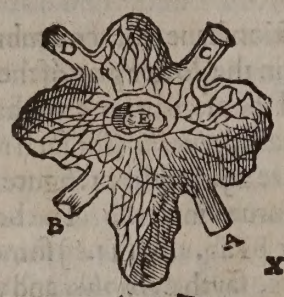
Figure 16. *sheweth the* Rete-mirabile *or wonderfull Net, together with the glandule as it is found in the heads of Calues and Oxen.*

TABVLA VII.

FIG. XIII.

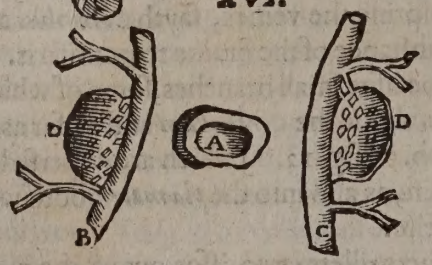


XIV.



XV

XVI.



A. The internall Iugular veine.
B. The sleepy or Iugular artery,
C. the first veine.
D. the 2 veine which is led vnto the *Sinus*.
E, the 3, creeping through the *dura meninx*
F, the fourth running into the *Sinus*.
G H, the 5 and 6 going to the *dura meninx*.
I, the first Artery.
* A braunch of the same Artery running through the Muscles of the necke.
K, the second artery reching into the *sinus*
L, the third without a companion.
r A small branch of the third Artery.
M, N, the 1 & 2 *sinus* of the *Dura Meninx*.
O, the congresse or meeting of both those *sinus*. PP, the *3 sinus* of the *Dura Meninx*
Q, The end thereof.
R, the fourth *sinus* of the *Dura meninx*.
SS, Branches of the first *Sinus* deriued into the Membranes neere at hand.
TTTT, Branches of the third *Sinus* dispersed into the *Pia Meninx*.
V V, the lower smal branches of the 3. *sinus*
X *X*, the vpper, distributed through the *Dura meninx*.
Y Y, certain surcles of the 4 *Sinus* sent vpward. *aa*, Others sent downward.
b, the vpper passage of the fourth *Sinus* running by the *Syth*.
cc, Surcles runing vpward from this passage
de, the right & lest vpper branches of the fourth *Sinus*. *f*, The lower branch going to the *Pia mater*.
g, A branch of the same pas. going forward
h, The same bending backewarde to the *Choroides* reflected to the *Cerebellum*.
i, A notable vessell into the which the 4. *Sinus* doth determine.
K the vpper. The by-partition of this vessel in the braine.
l, *m*, Two branches of this by-partition.
n. A surcle reching to the organ of hearing
ooo, the distribution of the 3 vein & artery,
ppp, Surcles proceeding from the Brãches marked with *o* deriued into the *pia mater*
φ, The diuision of the third artery where it entreth into the scull. *s*. A braunch reaching to the hollownes of the nostrils
t, the end of this in the extreamity of the vessel. *uu*, 2 branches entring into the scul
x. A branch deriued vnto the eie from the coition or meeting of the 2 branches *uu*,
e, A branch attaining to the *pia mater*.
A, A brãch attaining to the right ventricle
♪ The complication of vessels called *Plexus Choroides* formed on either side of the

branch marked with A. *Fig.* 14. A, B, Arteries climbing into the scull, and making this wonderful net, C, D, Branches into which the surcles of that net are ioyned. E, the pituitary glandule or kernel of flegm *Fig*: 15. A, the Glandule receiuing the bason. B, the bason it selfe, or if you wil, the Tunnel called *Peluis* or *infundibulum*. CC, the sleepy Arteries. D, A branch of the artery going to the side of the *Dura Meninx*. E, Another branch of the same artery going to the nostrils. FF, An artery in one side diuided into 2 branches, but in the other side meeting togither againe. G. A partition of the artery creeping through the *dura meninx*, H, Another branch which getteth out of the scull and reacheth to the eies. *Figure* 16, A The petuitary Glandule. B, C. The sleepy Arteries going into the scull. D, D. The wonderfull Net.

neth forward [Tab.7,fig.13,ᵍ] through the Circles of the braine and endeth in the lower seate of the ventricle,& is ioyned with an artery ascending thither [Tab.7,fig.13,ʸ] to make as they say that web of vessels which they cal *Plexus Choroides*, because it is somewhat like the after-birth called χοριον. The other branch is reflected backeward to the *Cerebellum* [tab 7,fig.13,ᵍ] & is diuersly sprinkled into his *pia mater*. Finally,and at length this fourth *sinus* determineth into a notable vessell couered with the *pia mater* [Ta.11,fig:7ˣ.tab:7,fig.13ᵏ] which neere the testicles of the brain,so called, is diuersly diuided and knotted & so goeth vnto the Glandule called *Pinealis* and vnder the arch of the brain called *Fornix* runneth into the inside of the third ventricle & there is parted into a right branch & a left. The right branch reaching [tab,7,fig.13ˡ,] vnto the right ventricle and the lefte vnto the left. [Tab. 7,fi.13ᵐ]& Anatomists do think that they are mingled & ioynd to the branches of the first and fourth arteries to make that *plexus choroides* of which we made mention euen now.

Where the 4 *sinus* endeth.

These *sinus* or cauities of the *dura meninx* haue not the coats of veins but are in substance like to the Meninx it selfe.For as soone as the veine (put case the internall iugular) toucheth the scul,the *dura meninx* is there presently duplicated & the inside becommeth fistulated or hollowed like a pipe,& with these pipes as if they were veines the veines themselues are ioyned. They do the office both of veines and arteries, for they beare like arteries sayth *Platerus*,they receiue into them both veines and arteries (although *Fallopius* thinke they receiue only veines) and the blood and spirits of them both. For they are full of blood which they preserue as they receiue it full of spirites, but after death this bloode cloddeth into a grainy substance, haply because the bloode they receiue out of the vessels is a little thicker then ordinary saith *Bauhine*.They send also out of themselues scions and surcles like to the branches of Veines which passe vnto the Braine and both the Meninges.

The matter of these *sinus*.

They doe the office of veins and arteries.

For because the Braine is large and standeth in neede of a great quantity of blood, but yet cannot admit any notable branches of Veines and Arteries to runne thorough his substance, Nature made these *sinus* or rillets to be in stead of veines and arteries to passe thorough and irrigate or water the whole substance thereof: for into them there is continually powred great abundance of blood which is mingled, the Venall I meane with the Arteriall, and afterward conneyed by these pipes vnto the convolutions of the Brain,yea into his very substance,aswel for his nourishment and life as also for the generation of the Animal spirits which are wrought within his substance.For seeing these Animall spirits are continually supplyed vnto the instruments of sense and motion,and by motion are spent & dissipated, it was necessary there should be great quantity of both kinds of bloode in this place mingled together to make supply of them.

why the brain needeth much blood.

The vse of the *Dura Meninx* is,to hold together the whole substance of the Brain and be a couering thereunto and to all the parts of it, for it compasseth about the spinall marrow also,yea and all the Nerues that yssue out of the Braine. It also defendeth the brain from the impressions of the Scull or compresions if by any outward iniury it be beaten downward. It also preserueth the Arteries which runne in the surface of the Brain,that in their *Diastole* they be not offended by the hardnesse of the Scull.

The vse of the *Dura Mater*.

Moreouer, it diuideth the Braine from the after-braine or *Cerebellum*,as also the braine it selfe into a right part & a left.Finally,it produceth Ligaments through the sutures of the scull to make the *Pericranium* and to fasten it to the scull,that it might not sinke downe toward the braine,as also to hold vp the braine it selfe least setling down it should compresse the Ventricles which would cause sudden death. And thus much concerning the *dura mater* or *Meninx*,wherein we haue beene somewhat prolixe,that nothing might escape worthy your obseruation.Now it followeth that we entreate of the *Pia Mater* or thin *Meninx*. The *Dura mater* being taken away we meete with the second Membrane called *Pia mater*, delineated vnto you in the sixt Table and the second Figure, but in the ninth Table & the third Figure ᵖᵖ sheweth the *Dura Mater* and ᵒᵒ the *Pia Mater* of which we now speake.This Membrane euen considered of it selfe, as also in comparison with the other Membranes of the body is exceeding thin, and therefore called λεπτὴ μηνιγξ by *Galen* in his ninth booke *de Administrationibus Anatomicis* and the second Chapter. The name he had out of *Hippocrates* his Booke of the Falling sickneesse,where he saith that this λεπτὴ μηνιγξ diuideth the middle of the Braine,or the Braine in the middest.*Galen* also in his eight Booke of the vse of parts and the ninth chapter calleth it μηνιγξ χοροειδὴς,that is the Membrane like the *secundine* or after birth,because it conteyneth or holdeth fast the veins and arteries of the brain, least whilst they moone they should be displaced,their basis or foundation being but weak and infirme.

The *Pia mater* or *tenuis Meninx*.

His Names.

His figure. Magnitude. This membrane is for the moſt part conteyned within the skull immediatly couering the brain and there is iuſt of his figure. In magnitude anſwerable to the braine & the parts thereof; but the ſubſtance or body of it is exceeding thinne and fine, and yet *Cabrolius* and Subſtance. *Laurentius* ſay it is doub'e. It is thinne that it might more eaſily inſinuate it ſelfe into the conuolutions of the braine, and yet not be offenſiue by the waight of it to the brayne vpon which it lieth, and beſide to carry the veſſell quite through the ſame [tab. 6. fig. 2. ᵃᵃᵃ table 9. figure 3. °°.] It is ſoft and of exquiſite ſence becauſe it communicateth the Tactiue vertue to the Brayne and the Nerues; and *Archangelus* ſayeth it is the very inſtrument of *Touching*.

The counſel of Nature. This Nature placed betweene the brayne and the *dura meninx*, leaſt the braine ſayth *Galen* in his 8. booke of the *Vſe of parts* and the 9. Chapter ſhould be offended by ſo hard a neighbour. For euen as ſayth *Plato* betweene the earth and the fire becauſe their natures are very contrary, God interpoſed the water and the ayre, ſo *Galen* ſayeth that Nature betwixt the brayn and the skull which are partes of very different ſubſtance hath placed theſe 2. membranes or minniges. For if there had been none but this thin *pia mater* it could not haue agreed with the skull without offence, if there had beene none but the *dura meninx*, yet the braine would haue beene therewith offended. That therefore neither the braine nor his couer ſhould endure any vncouth violence, Nature hath immediately couered the Braine with this *pia mater*; and then the *pia mater* hath ſhe compaſſed with the thicker; for by how much the thicker is ſofter then the bone, by ſo much is the braine ſofter then the thinner.

If you would know what diſtance there is betweene theſe two membranes, you muſt make a little hole in the thicker, and then put a hollow bugle to it and blow it and you ſhal perceiue that the diſtance between them will containe a great deale of ayre, by which you may imagine how farre they were ſeuered when the man was aliue.

The progreſſe of it. This membrane doth not onely cleaue cloſely to the braine and couer it immediatly as his naturall coate, as a mother embraceth her infant (whence *Platerus* thinketh it was called *pia mater*) leaſt the ſoft and moyſt ſubſtance thereof ſhould be ſeuered by the continual motion wherwith it is wrought vp and down (for we perceiue that the brain wil eaſily run abroad when it is taken away) but alſo it inſinuateth it ſelfe into the bottome of the braine, and extendeth it ſelfe vnto the inſide of the cauity of his ventricles ſaith *Galen* in his 8. book of the *Vſe of parts* and the 8. chapter, lining them round within. The vulgar Anatomiſtes ſayth *Laurentius* thinke that it paſſeth into the ventricles from the vpper part of the brayn; but the truth is that it aſcendeth from below where the *Infũdibulum* or Tunnel of the brain is ſcituate, and where thoſe ſmall arteries deriued from the ſleepy arteries called *Carotides* do paſſe into the brain at the ſides of the wedge-bone; ſo that euen in the bottom it meeteth; without the skull it cloatheth the marrow of the backe and the nerues. The bones *Archangelus.* alſo ſayth *Archangelus* doe ſeeme to bee couered with this thinne membrane, which nowe hauing with his vſe changed his name is called *Perioſtium*. But how it maketh the *Infundibulum* or Tunnell called alſo *Peluis* the Baſon, and how it inueſteth the vpper part of the phlegme-glandule, we ſhall declare afterward.

The vſe of the *pia mater*. The Vſe of it is, to couer and eſtabliſh the braine, the after-brain, the marrow of the ſpine and the nerues, as alſo all the veſſelles which runne through it, it knitteth together, ſo that they are more ſafely and commodiouſly diſtributed through the whole body of the Brayne and through all his partes. Adde hereto that which *Archangelus* determineth in the firſt Booke of his Anatomy, that it is the moſt exquiſite and proper inſtrument of the ſence of *Touching*.

CHAP. VIII. *Of the veſſels diſſeminated through the Brayne.*

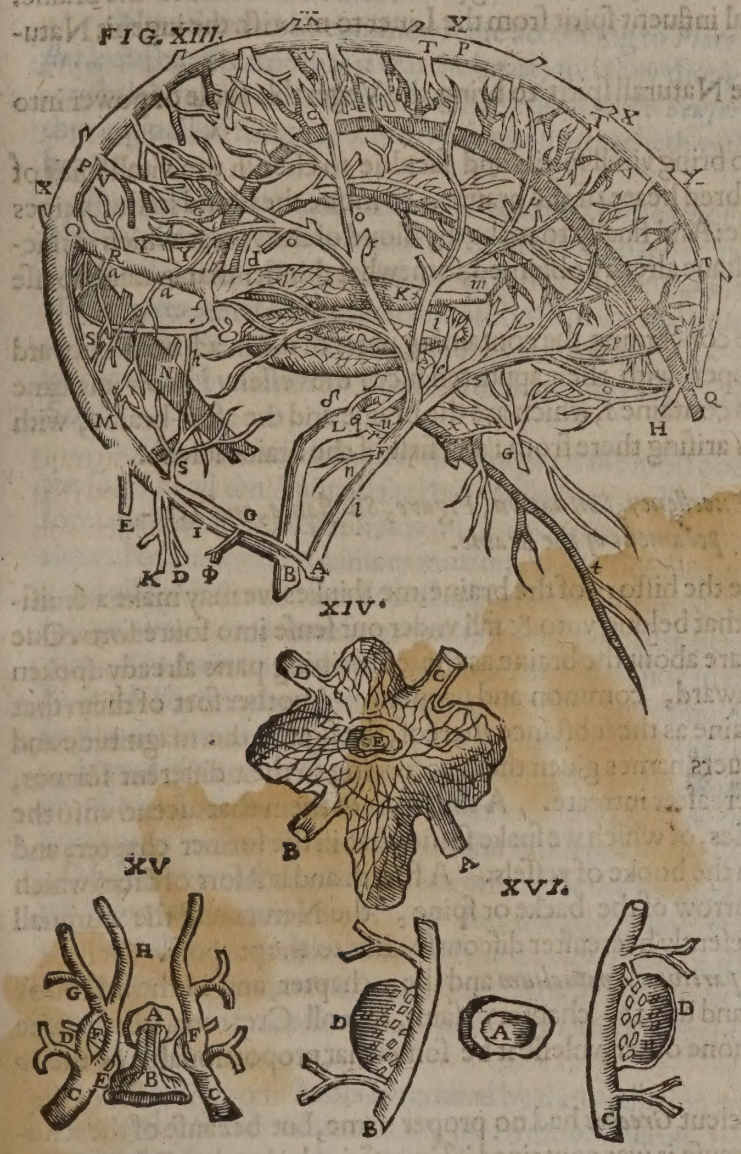
THE veſſels diſſeminated through the Braine are Veines and Arteries and thoſe *Sinus* or Canalles whereof wee intreated at large in the former Chapter.

The veines. The Veines are braunches of the inner or vtter Iugulars: the Arteries of the *Carotides* or ſleepy Arteries, and of that we call *Ceruicales* or the artery of the necke.

The inner iugular. The inner Iugular at the Baſis of the skull in the backpart [table 7. figure 13. at ᴬ] is deuided into two brãches, one bigger which watereth the backpart, & another ſmaller branching

ching forward. The bigger [Tab.7,fig.13,the lower [c]] attaineth into the braine at the firſt hole of thr Nowle-bone.[Tab.4,fig.10,[b]] The leſſer,[Tab.6,fig.1,[pp]] getteth into the braine at the ſeauenth hole of the wedge-bone. [Tab.4,fig.10,[s]]

The vtter Iugular veine ſendeth three branches into the Scull: the firſt [Tab.7,fig.13,[e]] entreth into the *Sinus* of the *dura meninx* through the hole of the temple bones. [Tab.4, fig.10,[e]] The ſecond [Tab.7,fig.13,[e]. Tab.14,fig.19,[hh]] paſſeth in at the ſecond hole of the wedge bone.[Tab 4,fig.10.[q]] The third [Tab.7,fig.13,[n]. Tab.14,fig.19,[ll]] is diſtributed into the *dura meninx*, and getteth in at the hole of the ſpongy bone. The vtter Iugular.



Beſide theſe fiue veins, *Veſalius* and *Platerus* add another, to wit, the end of the Necke veine which entreth the Scul (ſay they) at the third hole of the Nowle bone which was purpoſely made for it. But *Bauhine* could neuer obſerue it; yet wee haue added it in the Table. [Tab.7,fig.13,[p].] Thus much of the veins, now of the arteries. Another vein of *Veſalius* his finding.

The ſleepy artery called Carotis whē it is come on either ſide to the Chops is diuided into two branches, one exterior of which heereafter, the other interior which is the larger of the twain. This at the Baſis of the Scull [tab. 7,fig.13,[s]] is diuided into 2. vnæquall branches. The firſt is a little leſſe then the Trunke, [tab.7,fig.13,[t]. fig.15,[ee]. tab. 14,fig.19,[ff]] pierceth the Scull through a proper hole of his owne thrilled in the temple-bone, paſſeth vnto the ſaddle of the wedge bone and then ſheaddeth a branch on each hand into the ſide of the *dura mater*,[tab 7,fig.15,[p]] and afterward being diuerſly carried and diuided (as wee ſhall heare more diſtinctly in the booke of veines) it helpeth to make the *Rete mirabile*. [tab.7,fig.14] and the Plexus Choroides. From this firſt iſſueth a branch obliquely, [tab. 7,fig. 13,[q]] and getteth into the braine at the ſecond hole of the temple-bone, and then is diuided into two branches, the one running outward [tab.7, fig.13,[f]] through the eight hole of the wedgebone into the cauity of the Noſe: [tab.7,fig. 15,[f]] the other inward,which is diuided into two,[tab.7,fig.13,[uu]] and after diſtributed into the Dura Meninx; and this is called the ſecond artery, though it ariſe out of the firſt. The arteries. The firſt The ſecond. The third.

The third artery [Tab.7,fig.13,[r]] is the other branch of the inner trunke of the Carotis, much leſſe then the firſt; getteth in at the firſt hole of the nowle-bone,[Tab.4,fig.10,[b]] and ſo paſſeth into the *Sinus* of the *dura meninx*.

There is alſo one other artery called *Ceruicalis* which is a ſprout of the axillary artery, it perforateth the *dura meninx* in the ſide where it inueſteth the ſpinall marrow and entreth the Scull at the ſame large hole whereout the marrow iſſueth, and aſcendeth vnto the place of the Glandule called *pituitaria* where it is diuided into two branches, which helpe to accompliſh the Plexus Choroides. A fourth.

Beſide

The *Sinus* of the *Dura meninx*.

Beside these veines and arteries; the *Sinus* of the *dura meninx* is also a vessell of the brain which we haue at large discribed before. It receiueth three veines, [Tab. 7, fig. 13, [c D]] and two arteries [[I K]] which vnburthen themselues into it: and this *Sinus* according to his diuers course is distinguished into foure as you haue heard, which are larger then the veines that ascend vnto the Scull but not round as they are, but rather like a triangle consisting of three ribs of an equall length and curued somewhat inward. From these do issue certaine passages like vnto veines, by which both sorts of bloud Naturall and Vitall, is distributed into the substance of the braine as we haue said before.

The vse of the veines.

The vse of the veines is three-fold, first to bring plentifull nourishment to the braine. The second, to bring a Natural influent spirit from the Liuer to nourish the ingenit Naturall spirit of the braine.

The third, together with the Naturall spirit to bring the Vegetable soule or power into the braine.

The vse of the Arteries.

The vse of the arteries is to bring vitall spirits and facultie to cherish the vitall spirit of the braine, to ventilate the in-bred heate of the braine, to moue the bloud in the veines which otherwise would putrifie: And finally to make the bloud of the veines which is thicker heere then ordinary as we haue already obserued, somewhat thinner that it might passe and repasse more freely.

And thus much shall suffice concerning the containing parts of the head both outward and inward, common and proper, with their appurtenances the vessels. Now it is time we should come vnto the parts contained, which are the braine and the after-braine, with the spinall marrow and Nerues arising there from: and first of the braine it selfe.

CHAP. IX. *Of the Excellency, Scituation, Figure, Substance, and Temperament of the Braine.*

A diuision of the Head.

BEing to vndertake the history of the braine, me thinkes we may make a diuision of those parts that belong vnto & fall vnder our sense into foure sorts. One sort of them that are about the braine as the containing parts already spoken of outward and inward, common and proper. Another sort of them that are within the braine as the substance thereof, the figure, the magnitude and the diuers parts which haue diuers names giuen them according to their different formes, of which we will heere and heereafter intreate. A third sort of them that ascend vnto the braine, as the veines and arteries, of which we spake somewhat in the former chapter, and shall do more if God permit in the booke of vessels. A fourth and last sort of them which issue from the braine as the marrow of the backe or spine, the Nerues and the Animall spirit of which also we shall presently heereafter discourse: But to the purpose.

Aristotle.

Aristotle (in his 2. booke *de partibus Anamalium* and the 7. chapter, and in the first book of his History of Creatures, and the 16. chapter) saith, that all Creatures which haue bloud, haue also a braine and none other, vnlesse it be somewhat proportionable as the *Polipus*.

This braine among the auncient *Greekes* had no proper name, but because of the scituation it was called ἐγκέφαλος because it was contained ἐν τῇ κεφαλῇ in the head. Of the generation of it *Hippocrates* hath learnedly discoursed in his booke *de Carnibus* to which we referre the learned Reader; as also for the order of the generation thereof to *Aristotle* in his booke *de generatione Animalium* and the sixt Section.

The braine the principall part of the whole body, and why.

It is the principall part of the whole body which may be proued by the scituation, the figure, the defences it hath, and the vse of it. The scituation is in the higheste part of the body as it were in a defenced Tower, that it might bee better secured from outward iniuries.

The figure is round, which is the most noble figure of all the rest, for it was proportionable that the diuineft part should haue the most perfect and absolute figure.

The defences of the braine.

The defences of the braine are very many, the haire, the skinne and that the thickest of all the body, the fatte, the fleshy Membrane, the *Pericranium*, the *Periostium*, a double tabled Scull and two Meninges or membranes, by all which it is of all sides defenced from violence, so that it cannot be hurt or offended but with extreame wrong. But neyther the heart nor any other part is so prouided for by Nature, wherefore it should seeme she made more of store, as we say, of it then of all the rest.

The excellency of the vse of it.

In respect of the vse it will easily carry away the prize of Excellency; for the soule

of

of man saith *Varolius*, being not tyed to any bodily instrument cannot apprehend those outward things which are without it selfe, vnlesse it be by the mediation of a corporeall organ into which the *species* or formes of materiall things may be transmitted by which afterward they may be exhibited, and in which they may be apprehended and contemplated: euen as he that is shut vp in a roome, cannot see those things which are, or are acted without, vnlesse there be some Tralucent body wherin the Images of those outward things may first be receiued and after represented to him that is within. Such an instrument is that which wee call *Commune sensorium* the common sence, for nothing can come into the vnderstanding vnlesse it be first in the sence. Comparison.

Now this first or common sense according to *Plato* and *Galen* is the braine; (for *Aristotle* did but dreame that it was the heart) and they thought well. For not onely *Galen* but *Aristotle* himselfe did resolue that that was the first *Sensorium* or common sence, which is the originall of sinewes. Nowe Anatomy teacheth vs that all the sinewes arise from the braine. *Arist.* dreame. The common sence is the braine.

Hence then it is manifest that the Braine is the seate of the Sensatiue Soule; for if a nerue which is directed vnto any part be obstructed, that part is depriued of sence and motion & so of the sensatiue Soule. If the originall or beginning of the spinall marrow be obstructed all the parts vnder the head doe loose both sence and motion, when as yet the head enioyeth them both. But if the fourth ventricle of the Braine be obstructed, then not onely the whole bodie but the head it selfe looseth motion and sence, and is depriued of the sensatiue Soule.

Who then will deny that the Brayne is the most noble of all the members, seeing it is the seate of all the Animall faculties, Imagination, Reason or discourse & Memory (wherfore *Aphrodisæus* called it ὄργανον τῆς φρονήσεως *The Organ of wisedome*) and the beginning or originall of sence and voluntary motion; and beside seeing from it doe issue and on it do depend all the instruments of the senses of seeing, hearing, smelling, tasting, touching yea and speech also. And therefore *Plato* did worthily call it, because hee could giue it no higher a stile, *The deuine Member*. For what the Heauen is in the worlde, the same in man is the Braine. The Heauen is the habitation of the supreame *Inteligence*, that is of God; and the Braine the seate of the *Soule*, that is the *demi-God* of this *Little-world*. *Aphrodisæus.* *Platoes*

Hence it was that *Homer* called it κρανὸν, that is the *Heauen*, because as from the Cœlestiall influence all things below it are moued both in heauen and earth; so all the parts of the body haue sense and motion from the influence of the Braine. Comparison

Wherefore with *Galen* we determine that the Braine as well as the Heart is a Principall part: not that wee think, as some doe, that the Braine is the Prince and King of all the rest, no more then we thinke with *Aristotle* that the Heart is the most noble of all the parts. But we say that as the heart is of greatest and most instant necessity for life, so the place of dignity belongeth to the Braine. *Columbus* giueth an elegant reason hereof taken from Generation. The braine not the prince but a principal part. *Columbus* his reason.

The Liuer sayth hee is ingendred by the mediation and helpe of the vmbilicall veine, the heart by the mediation and helpe of the vmbilicall arteries, and these are ingendred by the vessels of the wombe: but the nerues which are the instruments of sence and motion doe immediatly arise out of the braine of the Infant.

The Braine is commonly called ἐγκέφαλος. *Galen* in his Book *de motu musculorum*, calleth it μυελὸς ἐγκεφαλίτης *The marrow of the head*, for a difference betweene it and the marrow of the backe which is called ῥαχίτης, and the marrow of the bones from which it much differeth, because it is not dissolued by fire, nor consumed in hunger, nor contained in the skull to nourish it. Wherefore *Galen* in his 8. Booke *de vsu partium* and the 4. Chapter putteth a difference betweene it and the marrow of the bones, because this is fluxible and like vnto fat, neither couered with coates nor wouen with veines and arteries, neither hath any communion with the muscles and nerues, all which is contrary in the Braine. The name of the braine.

Apollidorus thought that none of the Antients had giuen any name to the Brain in any of their writings, and that therefore *Sophocles* called it λευκὸν μυελὸν, the white marrow; imitating therein *Plato*, who when he would giue a name to the Brayne called it μυελὸν, and True Loue the Grecians say is ἐις ἄκρον μυελὸν ψυχῆς, *euen at the vppermost marrow or at the Braine of the Soule*, no doubt because they thought that the Soule was in the Braine. *Sophocles.* A greeke phrayse.

It is scituate in the head as in a Castle most safe, because of the defences thereof before mentioned; as also because it is the highest place, & as it were the Tribunall or throne

of

of her body. For as God who is the parent yea the Creator of the Vniuerſe is ſaid to haue his ſeate and throne in heauen. So the Braine which is the pallace of the ſoule was wiſelie ſeated in the height of the body, partly becauſe of the eyes and eares, for their nerues being ſoft had neede alſo be as ſhort as might be, and therefore placed neere vnto the brain. Now aboue they muſt neceſſarily be ſeated becauſe they are the ſcout-watches of the Bodie to foreſee and to heare of dangers before they come vpon vs.

Figure. The Figure of the Braine is anſwereable to the Figure of the Scull, not that it is faſhioned by the Scull, for if it had beene ſo, then the Scull ſhoulde haue bin formed before the Braine. Againe (ſaith *Galen* in his 8 Booke of the vſe of parts and the 12 chapter) they that ſay that the Braine is faſhioned by the Scull do not obſerue that the Brain is manifeſtly ſeparated from the *Dura Meninx*, and that the Meninx it ſelfe although it touch the ſcul yet it adhereth not vnto it. It expreſſeth indeede in the ſurface of it the forme of the cauitie of the ſcull, and when it is rightly formed it is round and a little longer then globous, becauſe of the ventricles which were to be formed therein.

Forward it is ſomewhat narrower, backward broader and on either ſide lightly depreſſed [Tab.6, fig.2 ſheweth this] but in thoſe that haue as we ſay *Læſa principia*, that is, in Ideots it is often otherwiſe faſhioned as we haue ſaid before. But in the Baſis it is vnequal & full of variety becauſe the ſcull hath there diuers dens and boſoms, eſpecially at the wedge-bone [Tab.14, fig.19 betweene [A] and the latter [B]] and the inward proceſſe of the Temple-bones. [Tab.15, fig.20, betweene H and N] But aboue all it ſweleth out forward at the inſtruments of ſmelling, and produceth two *teates* as it were [Table:14, fig:19, [CC]] vvhich are therefore commonly named *Mamillares proceſſus*. But where it coucheth vpon the *Cerebellum* or after-braine it is ſmooth and more equall. [Tab.14, fig.18, [AA], [BB]]

Magnitude. *Ariſtotle.* Concerning the magnitude, the braine of a man (ſaith *Ariſtotle* in his 2 Booke *de partibus Animalium* and the 7 chapter in compariſon and proportion with other creatures is the largeſt, ſo that the Braine of one man is more then three Oxen, firſt becauſe in man there are many Animall functions which beaſts haue not, and thoſe that we haue common with beaſts are in vs much more perfect. For being in man the inſtrument and organ of reaſon, it was neceſſary it ſhould conteine yea and perfect alſo great plenty of ſpirits. Now many ſpirits cannot be made but of much blood, and aboundance of blood cannot be conteyned in a little body. Againe, it was fit that the braine ſhould be large, moiſt, thick & glutinous that they might not by reaſon of their notable tenuity vaniſh away but paſſe into the whole body by proper and peculiar channels framed for them.

But the magnitude in length, bredth and thickneſſe is ſo great as the capacity of the ſcul is able to conteine, for together with his Membranes the Flegmaticke Glandule and the veſſels that aſcend vnto it; it filleth al his compaſſe [Tab.6.fig.1 and 2. Table.9. fig.3 and 4] before and behind, and on either ſide, only leauing ſo much diſtance as may ſuffice for his *Diaſtole* aud *Syſtole*. Finally, it is ſo great ſaith *Bauhine* that in our diſſections we haue found it weigh foure or fiue pounds; and *Archangelus* addeth fiue pound and a halfe; for the larger a man is the greater and more weighty is his braine, yea children becauſe of the waight of their braine cannot of a long time carry their heads ſteddy vpon their ſhoulders.

Connexion. It is knit by a common connexion of Veines, Arteries and Sinnewes with the reſt of the parts, although more familiarly to the ſpinall marrowe and the ſinnewes, becauſe they are produced heere-from. Hence it is, that when the leaſt or baſeſt part of the body is pained the Braine alſo partaketh of the ſmart. As for ſupportation and ſtrength it needed no aſſiſtance from the other parts becauſe it is ſo ſtrongly fortified and as it were intrenched with in the ſcull.

Subſtance. *Archangelus* *Praxagoras.* *Philotimus.* The ſubſtance of the braine hath a double principle of which it is formed, the ſeede and the Mothers blood. *Archangelus* thinketh it hath no ſuch principle, it may be he is of the opinion of *Praxagoras* and *Philotimus* of whom *Galen* maketh mention in his 8 book of the vſe of parts and the 12 chapter, who thought that the braine was nothing elſe but a production or propagation of the ſpinall marrow, and that was the reaſon why it is foulded vp in ſo many convolutions and revolutions. But this is an idle ſpeculation of a vvandering Brain. We wil determine as is ſaide that it hath a double principle ſeed and blood, of which is generated a peculiar kinde of glandulous ſubſtance like whereunto there is none in the whole body, ſo that *Ariſtotle* exceeding well in his 2. Booke *de partibus Animalium* and the 7 chapter ſaide, that it was *ſui generis* of his owne kinde, intimating thereby, that there vvas no other kinde in the whole body whereunto it might fitly be referred. For becauſe the in-

Ariſtotle.

genit

genit functions of the Braine are peculiar vnto it alone as *Vesalius* hath well obserued, it was framed and fitted by Nature for the performance of those functions, of a peculiar substance and essentiall forme wherein the principall faculties of the soule, Iudgement, Imagination, Reason and Memory might reside, and which they might vse as their proper instrument, and on which the rest of the senses might depend. *Vesalius*

It is white, soft and very moist. White by reason of his spermaticall matter, for it is made of the purest part of the seed furnished with abundance of spirits, as also that the Animall spirits therein conteined should be cleare and bright, not muddy or otherwise coloured. Yet is not all his substance perfectly white, for that which is neerest to the convolutions [Tab.9.fig.4. Ta.10,fig.5 ^EF] is somwhat neerer to an Ash colour, as it is also in the *Cerebellum*; the reason whereof some thinke to be because there are so many small veines disseminated through it. For as we thinke the *via lactea* or Milky Way in heauen is occasioned by an infinite number of small starres which to vs are inuisible, but yet do giue a brightnes to that part of the sky; so though we cannot see how the veines do alter the colour in this place, yet seeing it is altered, it is very reasonable that the insensible membranes of the small veines giue that ashie colour vnto it. The rest of the Braine a little more inward is pure white [Tab.9.fig.4,^GH. Tab.10,fig.5,^GH. Tab.11,fig.7 and 8,^EE] why the brain is white. Comparison.

It is soft, and softer saith *Galen* in his 8. Booke *de vsu partium* and the sixt Chapter then the *Cerebellum*, because it is the originall of the soft Nerues pertaining to the Organes of sense, but the *Cerebellum* is the originall of the hard Nerues commonly thought to bee the Nerues of motion. In Children the Braine is so soft that it is fluid. The reason of the softnesse is because it is to receiue all the species or representations of the outward senses, as also of the imagination and vnderstanding. For vnlesse the alteration or impression that is made in any of the senses do proceede first from the Braine and after returne againe vnto it, the creature hath sence of nothing; which is proued by the example of such as are taken with the Apopleixe. Wherfore seeing sensation is a passion, it was requisit that the braine should be of such a substance as is fit to receiue the impressions of other things. Yet it behooued not it should be so soft as that the impresions made therein, should presently sink away and be obliterated, as it hapneth in water and other fluide bodies, but that it should haue with the softnes a kind of consistence or solidity, which solidity is so exquisitely mingled with the softnes, that the fire cannot melt it as it doeth fat or wax and such like. To conclude it is like the substance of a nerue, of which also his marrow is the originall, but a little softer: *Hippocrates* in his booke *de Glandulis* likneth it vnto a kernell, because as a kernel it is white and friable, and beside is of the same vse to the head that a glandule would bee, drawing vp the exhalations of the lower partes which after vapour out by the Sutures of the skull. Why soft. Why not like to Fat. Why it melteth not.

The Temperament of the brayne is cold and moyst, as wee may easily with *Galen* in the 8. booke of the *Vse of parts* conclude from the softnes and moystnes of his substance. Wherfore *Hippocrates* in his book *de Carnibus*, calleth it μητρόπολιν τῆς ψυχρῆς καὶ τῆς κολλωδέος *the Metropolis* or chiefe seate of cold and glutinous moisture. Glutinous to hold and conteine the subtile Animall spirits which otherwise would soone vanish and decay; and colde that the part ordained for the exercise of reason and therefore fulfilled with hot spirits should not easily be set on fire or enflamed. For when the braine by any accident or distemper growes hot as we see in phreniticall patients, the motions thereof are furious and raging, and the sleepe turbulent and vnquiet. And indeede the Heade is verie subiect (colde although it be by nature) to hot distempers, partly because of the perpetuall motion thereof and of the spirits, partly by reason of the aboundant Veines and Arteries and great quantity of blood therein conteyned, and finally because whatsoeuer hot thing is in the body either naturall or vnnaturall if it be inordinately mooued flieth vp vnto the braine, or at lest sendeth hot vapors vnto it. The temperament of the Braine. The Reason thereof.

CHAP. X. *Of the Substance & parts of the Braine.*

AS the Braine is the Originall and seate of all the Animall Facuties, so for the exercise of the same it hath diuerse and different parts cast into sundry moulds which we will now take view of according to Anatomicall Method, alwayes remembring that by the Braine wee vnderstande whatsoeuer is conteyned within the Scull and compassed about by the hard and thin Membranes. why the brain hath diuerse parts.

The

3 Parts. The Braine therefore wee deuide into three parts. For first it is parted into a forepart and a hinde-part by the *dura meninx quadruplicated* or foure-foulded.

The forepart. The forepart because it is the greater and most principall (for in it the Animall spirites are especially laboured) reteineth the name of the whole, and is properly called *Cerebrum* or ἐγκέφαλος. The hinder part is much lesser, and is called by a diminitiue word, *Cerebellum*, we call it the After-braine. *Herophilus* as *Galen* witnesseth in his 8. book of the *Vse of parts*, and the 11. Chapter, calleth it παρεγκέφαλις.

Subdiuided. Againe the forepart or the Braine, by the *dura meninx* duplicated and resembling a Mowers Sythe, is parted in the top throughout his whole length into two equall parts, one right another left. [tab. 8. fig. 2. from ^A to ^A tab. 9. fig. 3. from ^N to ^K.]

This partition reacheth altogether to the Center of the Braine and stayeth at that body which we call *Corpus callosum*. [table 9. figure 3. at ^LL.] And this is the reason why alwayes the same part of the head is not pained, but sometimes one part sometimes another, sometimes the whole head.

Some, sayth *Laurentius*, haue dreamed that the braine is deuided quite through, but they are much deceiued, for the callous body vniteth the parts together. As for the after-braine though it bee not vnited to the braine, yet is it in two places continued with the beginning of the spinall marrow, and the same marrow by two originalles ioyned vnto the Braine.

The vse of this diuision Out of *Vesalius*. The vse of the diuision of the Braine is first out of *Vesalius* and *Archangelus*, that the braine might be better nourished, for by this meanes the thinne membrane together with the vesselles there-through conuayed, doe insinuate themselues deeper into the substance thereof: for without this partition and those deepe conuolutions which wee see in it when it is cut, it could not haue beene nourished.

Out of *Laurentius*. The second vse wee will adde out of *Laurentius*, to wit, beside the nourishment for the better motion of the same; for as water is not so easily moued where it is deep as where it is shallow; so if the braine had beene one entire massie substance, it would not so willingly and gladly as we say, haue risen and falne in the *Systole* and *Dyastole*.

Out of *Bauhine*. The vse of this diuision out of *Bauhine* is more expresse: for the safe conduct of the *Sinus* or pipes of the hard *meninx* mentioned in the seauenth Chapter, from whence doe issue small surcles of vessels to conuay nourishment into the conuolutions of the braine.

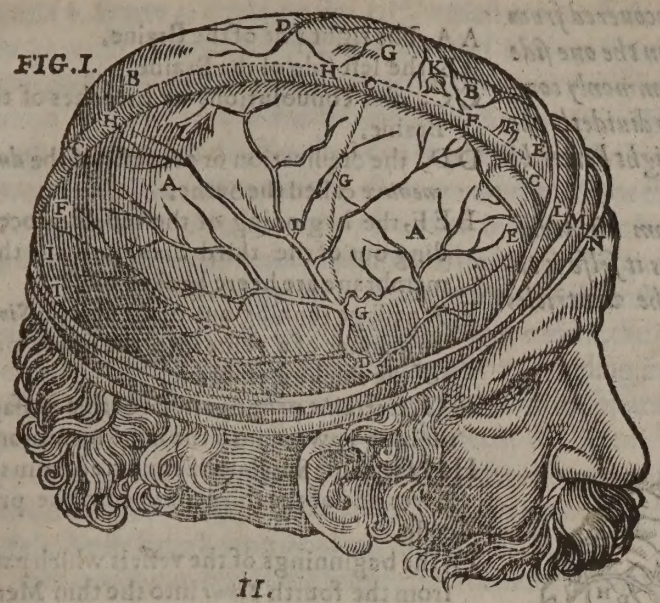
For because the quantity of the braine is very great, through which the *Capillarie* vessels were to be dispersed for his nourishment; if the vesselles themselues so small as they are veines and arteries, should haue passed from the backepart to the forepart, from the right side to the left, or on the contrary, they would in so long a iourney through so soft and clāmy a body haue beene in danger of breaking, wherefore the braine was deuided into three parts; betweene which diuisions there runne foure *Sinus* or pipes of the hard *meninx* into which the internall Iugular veines and the sleepy arteries called *Carotides* ascending from the Basis of the Nowle of the head doe powre their bloud and spirits; which is conuayed on either hand into the after-braine and the brain, by certaine branches deriued out of the height and depth & the sides of those pipes as we sayd ere-while, especially out of the third *Sinus*, into the left and right parts of the braine.

The Reason thereof. Finally, because soft bodies when they are great doe easily fall into themselues, therefore the braine was diuided into two partes that it might the better consist, as also that the instruments and organs which were led vnto it might not be shufled together: and somuch of the vses of the diuision of the braine.

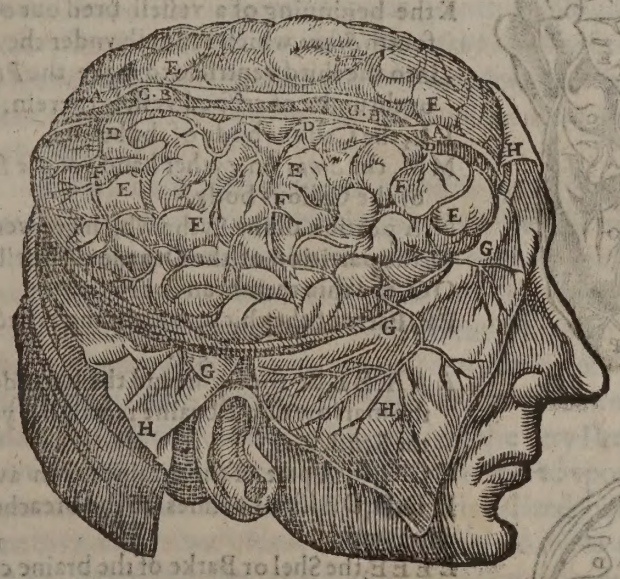
The conuolutions of the braine. Now the outward face of the braine which we sayed was of an Ash-colour rather then white, hath many and diuers orbicular circumuolutions and circular ruts, which the Antients sayeth *Vesalius* and those after him haue excellently compared to the gired windinges of the guts when the kell is taken off. [Table 8. figure 2. tab. 9. figure 3. c c c.] *Galen* in his 8. booke of the *Vse of partes* and the 13. Chapter calleth this *variam compositionem*, and *Vesalius* himselfe compareth them to the Clouds that a Painter maks in the roofe of a house. Some of these snailing paths are deeper, others do not pierce so deep into the substance of the braine [Table 9. figure 4. ^PP] and therefore are called *pars varicosa cerebri*, the knotted or embossed part of the braine by *Laurentius*. They are inuested with the *pia mater* or thin *meninx* (and when that is taken off may be better discerned) which not onely compasseth them and contayneth them in their superficies, but also with them in many places diueth into the depth of the braine.

Some

FIG. I.



II.



Some are of opinion that these conuolutions are onely framed of necessity, but haue no vse at all: but we with *Galen* do determine that their vse is to secure the vessels, that going together with the *Pia mater* they might carry vnto the braine nourishment and life, and not be in danger of breaking in the perpetuall motion and agitation of the brain. For the *Pia mater* being a thin and fine membrane and simple (not double that the vessells might run betwixt the duplication thereof) needed these winding Meanders to secure the vessels.

Their vses.

Galen.

But if the superficies or surface of the braine had bin smooth and æquall & the vessels had run along about the circumference thereof they had been subiect to breaking, especially in the *Dyastole* or Eleuation & in the full of the Moone, at which time the braine by reason of the humidity thereof so swelleth that the vessels must needs haue borne vpon the Scull. Beside, the vessells would not haue beene sufficient to haue irrigated and watered the huge and vast body & bulk of the brain if they had onely runne ouer the surface thereof. *Platerus* addeth further; because the venall and arteriall bloud arising to the braine is not yet fit for the vse thereof, it was necessary it should runne in proper vessels, and that into the inmost substance of his marrow where the inbred power of the braine might labour it and purge it from those excrements which are gathered and heaped vp in these Conuolutions, that being so prepared the braine might apply it vnto his nourishment and also for the procreation of Animall spirits.

Platerus.

Another vse of the Conuolutions remembred also beside *Bauhine* by *Archangelus* and *Laurentius* is; for the recreation of the spirits and the bloud contained in those vessels. For if there had not beene these gyrations in the substance of the braine, the vessels especially in the full of the Moone would haue beene so closely compassed by the Scull, that their motion would haue beene intercepted, and the spirit being compressed would haue beene suffocated or strangled, and the heate for want of ventilation extinguished.

Another vse out of *Bauhine* *Archangelus.* *Laurentius.*

Erasistratus thought that the braine of a man had more Conuolutions then the braines of other creatures because of his reasonable soule; which conceite of his *Bauhine*, *Archangelus* and *Laurentius* do sweetly smile at, when they behold the same conuolutions in the braine of an Asse, the most dull and stupid of all other creatures. Beside we learne out of *Galen* in his 8. booke of the *Vse of parts* and the 13. chapter, that vnderstanding followeth not the variety of the composition but the good temper and disposition of that bodye which vnderstandeth. *Laurentius* and *Columbus* thinke that Nature by these conuolutions prouided for the lightnesse of the braine, and to make it more prompt and ready for motion. But *Archangelus* taxeth them for it. As if (saith he) Nature could not haue made it of a lighter matter if that had beene behouefull, or a little lesse and so lighter? Beside

Erasistratus his conceite disproued.

Archangelus taxeth *Columbus* and *Laurentius.*

Tab.9. Fig.3. ſheweth the braine vncouered from both his Membranes, and laid on the one ſide that the proceſſe or duplication commonly compared to a Mowers Sythe, which diuideth the Braine; as alſo the Callous body might better be ſhewed.

Fig.4. ſheweth the Braine freed from his Membranes, as alſo a part of the braines it ſelfe is taken away that the marrow and the ventricles might be better diſcerned.

TABVLA. IX.

FIG. III.

FIG. IV.

A A, The right ſide of the Braine.
B B, the left ſide of the Braine.
C C, the conuolutions or breaches of the Braine.
D D, the duplication or proceſſe of the *dura meninx* called the Sythe.
E E E, the beginning of the veſſels proceeding out of the third *Sinus* into the thin membrane are heere broken off.
F, A paſſage running out of the fourth *Sinus* in manner of a veine into the lower part of the thicke membrane,
G G, Certaine propogations of this paſſage running vpward into the ſame membrane.
H H, Certaine Surcles diſſeminated from the lower ſide of the third *Sinus* into the proceſſe.
I I, the beginnings of the veſſels which paſſe from the fourth *Sinus* into the thin Membrane.
K the beginning of a veſſell bred out of the fourth *Sinus*, which runneth vnder the arch into the third ventricle to make the *Plexus* or thrumbe of criſped veſſels therein.
L L, the Callous body of the braine.
M M, the *Sinus* on eyther hand, at the ſides of the Callous body.
N, A portion of the Sythe which groweth to the partition of the Organe of ſmelling.
O O, the thin membrane or *Pia mater*.
P P, Parts of the thicke membrane reflected.

Fig.4.

A A A, B B B. the right and the left ſides of the marrow of the braine remaining yet in the Scull,
C C C, A part of the braine taken away.
D D, D, Diuiſions or lines frō the breaches of the braine.
E E E E, the Shel or Barke of the braine compaſsing his marrow.
G G, H H, the marrow of the braine which when it is preſſed is full of red points or ſmall drops or graynes.
I I I, the Callous body freed on eyther ſide from the ſubſtance of the braine.
K K, A part of the Callous body. L L, M M, the right & the left ventricle of the braine.
N N, A part of the vpper ſide of the left ventricle.
O O, the complication or thrumbe of veſſels called *Plexus Choroides*.
P P, Small veines growing to the ventricles.
Q. Other veſſels running frō the ſame veins into the *Pia mater* or thin membrane.

we ſee that the heart is of a moſt ſolid and firme ſubſtance without any of theſe gyrations & yet it moueth in *Syſtole* and *Dyaſtole* very freely. *Veſalius* and *Laurentius* adde that they were alſo ordained for the ſupportation of the ſoft ſubſtance of the braine that it might æqually be ſupported and not ſway too much to eyther ſide. And thus much for the vſes of theſe conuolutions as alſo for the vpper part of the ſubſtance of the braine.

Another vſe out of *Veſalius* & *Laurentius*.

Now the internall or inward ſuperficies hath in it diuers parts and impreſsions becauſe of the many vſes for which Nature hath ordained it. The ſubſtance therefore of the Braine is by *Archangelus* diuided into the Braine and the Marrow. The Braine he calleth that Aſh-coloured part which compaſſeth the reſt, whereby he meaneth the marrow: we will ſay it may be diuided into the Shell and the Kernell. The Shell is that Aſh-coloured bodye

The inward part of the Braine.

The Shell & the Kernell.

[Tab.

[Table 9. figure 4. Table 10. fig. 5.^{EF}] which compasseth immediatly the kernel or marrow. The kernell or marrow is that white body [Table 9. fig. 4.^{GH} Table 10. fig. 5.^{GH} Table 11. fig. 7. and 8.^{BE}] which is hid within the ash-couloured body and is somewhat more solide; for this white body is within the ash-coloured body as the christaline humor of the eie is in the glassie humour. Wherefore the shell differeth from the kernell first in colour, the one ash-coloured the other white; then in consistence for the shell is softer the kernell a little harder firmer and more compact; then in scituation because the kernell is in the middest the shell in the circumference distinguished with oblique and crooked lines.

Wherefore the kernel or Marrow is the middle and white body of the braine, of which there are two parts; one contayned within the skull, the other falling out of it and lengthned downe to the great hole of the *occiput* and ending in the spine of the back. These two bodies also, the shel and the kernel, may actually be separated if we haue the head of a sound man newe slaine and presently with dexterity dissected, otherwise both of them will grow very moyst and extreame soft, as it hapneth to the mammillary processes which are the instruments of smelling, which in a fresh body may easily bee parted at the marrow, but not so if the body haue beene dead any time. The kernel or marrow. Note this.

Now if you dissect the braine ouerthwart, about the middest of it you shall perceiue small vessels therein descending to his ventricles, and if the marrowey substance be pressed there will start out of it many drops or graines of bloud, which make me remember that of *Hip.* in his book of the falling sickneſſe. *Many and small veines doe ascend out of the whole body vnto the braine, and especially two notable, one from the Liuer another from the Spleene*: in the quest of which (if any such be) I would haue the great Anatomistes spend some of their curious howres. A difficult place in *Hip.*

Aristotle in the first booke of his History and the 16. Chapter is of opinion, that the braine is altogether without bloud (that we finde false by manifest experience) neither contayneth any veine within it, but that onely the Meninx about it hath veines. *Vesalius* leaneth too neare vnto him, for these are his wordes: The substance of the Braine and After-braine is neuer found with any veines therein, although you shall find in those that die mad or phreneticall and such as are hanged, certaine red and bloudy specks or spots; but these spottes carry no resemblance of a veine at all. Notwithstanding, though these two great Clarkes, the one the Genius of Nature and the very President of her priuy Councell and the other the Eye of Anatomie, haue thus resolued vpon the case: I presume there is something in that *Hippocrates* hath so particularly related, whose vse is not so peremptorily to seduce his Reader: but I leaue the disquisition to those whose meanes and oportunities are fit for such priuy searches, onely adding this one thing which I confidently auouch, that the onely writings of *Hippocrates* after so many ages and Commentaries past, haue in these dayes led the diligent and studious Readers into the knowledge of more mysteries of our Art, then all the writers in the world beside; for he alone is a boundlesse and bottomles ocean of Physicke: we returne to our history. *Aristotle.* *Vesalius.* Commendation of *Hip.*

If you lightly with your fingers deuide the sides of the braine till you come to a veine of a notable bigneſſe running through his length and sprinckling branches on either hand into the braine, there will offer it selfe vnto your view a body placed exactly in the middest of the braine [Table 9. fig. 3.^{IM}] gibbous or rising somewhat round [Table 9. figure 3.^{L}] in which sayeth *Archangelus* the two first ventricles are excauated, long, narrow, smooth and equall, whiter also then the vpper part as being made of the marrow or inward substance, which because it is harder and somewhat like a callus or hardneſſe of the skinne gotten by labour but much whiter is called τυλώδες σῶμα, by *Galen* in the 9. Booke of his Anatomicall Administrations and the third Chapter, that is, *A callous body*. It is a part continued with the braine, wherefore at the sides thereof in his length two *Sinus* or ventricles [Table 9. fig. 3. at^{N}] are hollowed in the marrow of the braine like deep lines or hollow pipes, which are esteemed to receiue the defluxion, of rheume, or phlegme out of the vpper partes of the braine, and to send it forward by the gibbous *superficies* of the callous body vnto the nose. But the vse of the callous body vndoubtedly is by his vpper part to sustaine the waight of the braine which lieth vpon it, and that by his mediation both the parts of the brain might be conioyned, as also to make a distinction or hedge which they call *septum* [Table 10. fig. *.^{RR} holdeth vp^{VX},^{XX}, and^{XY} lift vp^{SV}, least^{AAA} in the sixt figure should presse^{HI} in the same fig, or^{H} in the 7 and 8. figures of the 11. Table] which separateth the two ventricles; which partition it also sustaineth & lifteth vp the arch called *Fornix*, least falling downe it should *Archangelus.* The *Corpus Callosum.* The vse of it.

compresse the third ventricle.

A story out of *Bauhine*.

In this place sayth *Bauhine* in the yeare 1582. I found a scirrhus or hard tumor in the noble Baron *Bonacurtius* (who lay a long time in a manner Apoplecticall or astonished) when we opened his head after his death.

When we haue cut away the substance of the braine on either hand as deepe as vnto the Callous body before we lift it vp, we must mark the *septũ* or partition of the two first ventricles.

The *septum lucidum*.

This *septum* or partition [table 10. fig. 5. at RRR reflected backeward] in the vpper part groweth to the Callous body and is perfectly vnited thereto (wherefore *Vesalius* calleth it the inner or lower *superficies* of that callous body) but below it groweth to the place of the Arch or *Fornix*, so that it standeth in the middest between the callous body and the Arch. This *septum* before it be stretched is loose & rugous and doeth not shine, neither can you perceiue how it is continued with those bodies of the *Callus* and the Arch; but drawe it vp so high till it be streatched (and take heed it breake not for it is but thinne) and then if you

Diuersly compared.

put a waxe candle to one side of it you shall perceiue the brightnesse of the light through it as if it were through a glasse. *Vesalius* compares it to the host in the Masse, which being a thinne wafer and a little wet you may see a dull light through it; or say it is like a sliuer of the Muscouy glasse whereof we vse to make Lanthorns, or the horne of a lanthorn it selfe.

The names of it.

Whereupon *Columbus*, *Archangelus* and *Laurentius* haue called it *speculum*, *speculum lucidum*, *septum lucidum* and *lapis specularis*, the Looking-glasse. *Galen* giueth it a name from his vse in his 9. Book *Anatomicis Administrationibus*, the first, the third and the fourth chapters, calling it διάφραγμα τῶν προσθίων κοιλιῶν, *The partition of the foremost ventricles*, because the inner lips of the ventricles are hereby distinguished; wherefore you cannot aright perceiue it vnlesse both the ventricles be layd open, and if it be neuer so little too much stretched it easily breaketh, because it is so very thinne and subtile, yet cannot it not be manifestly seene vnlesse it be lifted vp.

An Anatomist therefore in these curious thinges had neede to haue a fine and a dainty hand and at command. This partition is of the same substance (sayth *Galen* in the book before named and the third Chapter and after him *Vesalius*) with the braine but thinner, and

The substãce of it.

in respect of his tenuity as it were the substance of the braine drawne out into a membrane.

Galen & *Vesalius*.

Columbus and *Archangelus* thinke it is nothing else then the *pia mater* in this place duplicated; but *Laurentius* and *Bauhine* agree with *Galen*. Yet though it bee thinne it is not simple, and it hath in the middest a little rising like a line [Table 10. figure 5. Y] which line bearing downward is by degrees lessened and becommeth the partition of the ventricles. [tab. 10, fig. 5. the lower part of the *septum* at x x the vpper at Y.]

Columbus & *Archangelus*.

These ventricles beeing taken away to the middest of their substance, wee meete with foure swelling particles: two before, about which is the Basis of the ventricles; two on the backeside making the Arch or *Fornix* of which wee will entreate in the next Chapter.

CHAP. XI. *Of the ventricles of the Braine, the Arch, and the Plexus Choroides.*

The ventricles of the braine.

ALthough the Cauity which is in the Brain be continuated quite through, yet because according to the forme of the Braine and the vse it is diuersly formed, so that one part is more dilated another more angustated or contracted; therefore the Anatomists haue diuided it into certaine places, and the larger of them they cal ventricles, the narrower they call *meatus* or passages. The ventricles called by *Galen* κοιλίας, the Antients and many of the new writers also following therein *Herophylus* haue reckoned foure. In the Braine three; two foreward a right and a left, and the third in the middest. The fourth they make common to the after-braine and the spinall marrow.

The first two of (these called by *Archangelus* the *Superior* because they hang ouer the other; by *Galen* in his 8. booke of the *Vse of parts* the 10, 11, and 12, chapters and diuers other places the *Anterior* ventricles) are cut out of the marrow of the braine and are the largest of all the rest, because (saith *Laurentius*) they containe a crasse spirit or rather aboundance of phelgme. They are on eyther side one, the right on the right hand and the left on the left, alike each to other in scituation, forme, magnitude and vse. They are scituate length wise in the marrow of the braine in the very middest thereof, [Tab. 9, fig. 4, Tab. 10, fig. 5, L

fig.

fig. 6, the right is noted with [D] but the left in the 9 Table and the 4, figure and the 10. Table and the fift figure at [M] in the 6. figure at [E]] whether you respect the length or the depth of it. In their fore and hinder parts they are broader and more disioyned, in the midst lesse where they are only diuided by that thin partition we spake of in the former chapter. [tab. 10, fig. 5, [XX YY]] They runne obliquely or semicircularly saith *Archangelus*, [Tab. 9, fig. 4, from [L] to [M]] for beginning about the temples where the marrow begins, they are by little and little curued toward the center of the marrow, and at the Region of the Eares they are bent againe, and so seeme to make two Semicircles. They are long, winding & somewhat large. Their forepart is blunt and round [tab. 9, fig. 4, and tab. 10, fig. 5, [L] and the lower [M]] and in their inside they sinke downe vnto the third ventricle, [Tab. 10, fig. 5, vnder [S T V] and in the 6. figure at [N] and [I], in the eleuenth table and the 7, fig. at [H]] whereupon some who haue not diligently followed their curued passage haue thought that beside these two there are other two ventricles in the forepart of the braine, and so haue made vp the number of sixe ventricles; but we esteeme them to be portions of these vpper, for they are indeede larger then vsually they are esteemed. Backward also they are obtuse and round, [tab. 9, fig. 4, the vpper [L] and [M]] and do descend by degrees downeward into the substance of the brayne, and foreward are straightened like the small end of a horne, and so creepe on to the mammillary processes and the ingresse of the optick Nerues [tab. 11, fig. 7, and 8. [E G]] and the sleepy arteries. Their vpper face is lined with a wateriſh moysture, and they are often found full thereof. Their vpper part [tab. 9, fig. 4, from [L] to [L] and from [N] to [N]] according to the length of the braine is smooth and æquall; the lower part is vnæquall, [tab. 10, fig. 6, [R] or [S]] because of the hollownesse prepared to receiue the defluxion of the phelgme; which hollownes creepeth obliquely out of the backepart of the ventricles foreward into their common cauity: For these two ventricles, as we shall say by and by, do determine into a common cauity. *Galen* and the ancients after him do write that the superficies of the first three ventricles are as the brayne couered with the *Pia mater*. *Vesalius* denyeth it and addeth a reason: for, saith he, if the ventricles were lined within, the Membranes would hinder the substance of the braine from working the matter conueyed into them into Animall spirits. But *Columbus* and *Archangelus* side with *Galen* against him, and *Archangelus* thinketh that the *septum lucidum* is made of the duplication of the *Pia mater* after it hath inuested these ventricles. We leaue this to be farther scanned by the curious Dissectors: sure we are that that which is called *Plexus Choroides* lyeth vpon them, from whence small veines [tab. 9, fig. 4, [P P]. tab. 10, fig. 5, [P P] figure 6, [° °]] are deriued which grow in the forepart to their substance, like vnto those which runne through the coate of the eye called *Tunica Adnata*. *Archangelus* is of opinion that the *Pia mater* being it selfe of exquisite sense may by meanes of these small veynes suffer inflamation, whence come those deepe paines which are sometimes felt in the Center of the brayne. And indeed *Galen* maketh expresse mention both of the *Pia mater* compassing their cauity as we haue saide before, as also of these veines which insinuate themselues into the ventricles in the second and third Chapters of the 9. Book of his Anatomicall Administrations: so that *Archangelus* doeth but gather the conclusions out of *Galens* præmises.

Their figure.

The water in them.

Whether they bee lined with the *Pia mater*. *Vesalius* against *Galen*.

The cause of deepe paines in the head.

It behooued sayeth *Galen* in the 8. Booke of the *Vse of Parts* and the 10. Chapter, that there should bee two of these ventricles, (because the Braine and euery organ of sence is double; for the braine is the first and most common cause of all those double organs) that if one of them be violated, the other might serue the turne; and this hee prooueth by an instance of a young man of *Smyrna*, who was wounded into one of these ventricles and yet escaped: but sayth hee, if both of them had beene wounded he could not haue liued a moment of time.

Why two ventricles out of *Galen*.

A story by him cited.

Vesalius (as he is an importunate aduersary of *Galens*, the lesse his thanke) reproueth him for this, alledging that though the braine be parted into two, yet it is againe vnited before the ventricles are formed therein; and to say trueth it is hard to conceiue how one ventricle should be wounded and the other not violated, considering the thinnesse of the membrane or partition that parteth them, and beside the common cauity whereinto they both determine; but experience often assureth vs of that which meere Reason and discourse wil not allow of or subscribe vnto.

Vesalius oppugneth him not without some reason.

The vse of these ventricles is according to *Galen* in his eight Booke of the *Vse of Parts* Chap. 10. and 11. that of the ayre which we draw in conuayed into the brain by the organs of smelling & of the vitall spirit ascending from the hart by the sleepy arteries, the Animal

The vses of these ventricles. *Galen*.

Archangelus. Laurentius. spirites prepared before in *plexu choroide* might in those ventricles bee perfected, but how perfected? *Vesalius* thinketh by the particular substance and forme of the Brain. *Archangelus* thinketh they haue no such vse or power as to make Animall spirites. *Laurentius* sayth that they serue for the inspiration and expiration of the Braine, to receiue smels and to prepare the Animall spirites, and to containe them as it were in a store-house yet not perfectly accomplished but inchoated onely. *Archangelus* subscribeth vnto this and addeth moreouer, that the ayre drawne through the nose and spongy bone into the ventricles, is laboured and prepared for the nourishment and refection of the Animall spirites, as the ayre is prepared in the Lungs for the refrigeration & recreation of the vital spirits. Another vse sayth he of them is (but that onely a secundary vse) to serue for wayes whereby the excrements of the braine may be purged. Neither sayth he, is there cause why we should wonder that the same ventricles should hold the Animal spirits and serue also for the ablegation of excrements, seeing we know that Nature hath ordained the Nose first and primarily to be a meanes of smelling, and secondarily to call out the phlegme out of the brain and auoide the same.

Archangelus his other vses

Bauhine. Wee sayeth *Bauhine* thinke, they serue to gather the excrements which are separated in the nourishment of the Brain, the phlegme (for example there) engendred, and by their common passage to send it into the Tunnell called *Infundibulum* to bee conuayed away by the throate.

A passage to be obserued. *Archangelus* in this place maketh mention of a passage which is (sayth he) is in the middest vnder the mamillary processes and hath a double issue, one directly into the ventricles wee speake off, the other into the pallate and so into the Lungs. This passage is knowne but to a few, neither can it be found but in a sound Brain when the man commeth to a sudden and vnlooked for end and is presently dissected; for the partes of the braine that are about this passage do in a short time so fall and close together that the passage is cleane obliterated.

Galen explayned. Hence *Galen* in his 8. booke of the *Vse of parts* and the 10. Chapter sayed, that the ayre we breath in by our noses passeth vnto the heart, but a part of it getteth into the ventricles where it is prepared and made the nourishment of the Animall spirites. *Columbus* ascribeth the finding out of this passage to himselfe, but *Archangelus* taxeth him therfore. And so much of the two first ventricles.

The 3. ventricle. The third ventricle followeth, which is nothing else but the concurrence or meeting of the two former lengthned out somewhat backward. For the two former ventricles in their lower part vnder the Arch [Table 10. fig. 5. ^{STV}] figure 6. ^{AAA}] do meet together in one place & there determine, being in their nether parts like a narrow path which runneth out backe ward a pretty length into the hindmost ventricle. This is called by *Galen* in his 8. booke of the *Vse of parts* and the 12. Chapter, the common cauity or common place of the foreward ventricles; [Table 10. figure 6. vnder ^{K}] table 11. fig. 7. and 8. ^{K}] by others who doe deny the third ventricle it is called the perforation of the two former ventricles: others call it the third ventricle or the middle ventricle, because it is in the middest of the braine, yea and in the very Center of the marrowe betwixt the two forewarde ventricles and the fourth.

Galen.

The forme of it after *Galen.* This at the first sight is like a long slit or cauity, [Tab. 11. fig. 7. and 8. ^{K}] but more backward it becommeth larger, and is discerned, part of it when the arch is drawne a little backward, part of it when the Testicles and the Buttocks of the braine are diuided in the midst. It tendeth directly from the forward ventricles vnder the arch, the testicles and the buttocks, [Table 12. fig. 10. from ^{I} to ^{K}] toward the fourth ventricle [Tab 12-fig 10. ^{K} sheweth the end of it]. And this is *Galens* delineation of his passage in his 8. book of the *Vse of parts* and the 11. chapter, whereunto *Vesalius*, *Platerus*, *Archangelus* and *Laurentius* do subscribe, but *Columbus* maketh it shorter and sayth it endeth at the backeward passage neare to the *Glandula pinealis*. The figure of it sayeth *Archangelus* is vncertaine because there are many eminencies or inequalities in it.

The two passages thereof. This third ventricle hath two passages, of both which *Galen* maketh mention in his 9. booke of Anatomicall Administrations and the fourth Chapter, the one he calleth the vpper hole or the Tunnell, the other the great hole of the third ventricle, wee according to *Bauhine* will describe them thus.

The first. The one [Table 11. fig. 7. and 8. ^{I}] proceedeth out of the middest of the ventricle and is reasonable large: it is caued in the substance of the braine and runneth directly downward

to-

toward the *Bason* which receiueth the phlegme at the Basis of the braine, and by it the phlegme of the two forward ventricles doth descend.

The other passage [Table 11.fig 7. and 8. [K]] which is the more backeward(*Laurentius* addeth the larger also) is not round in his originall although it be a part of the third ventricle which is round. *Galen* in the 9,booke of his Anatomicall Administrations and the 5. Chapter, thinketh that it hath a peculiar coate like that of the *pia mater* wherewith it is lyned. It runneth vnder the Buttocks [Table 11,fig.7.[MN] fig.8.[NOPQ] table 12.fig.19.[DEFG]] and the Testicles into the fourth ventricle aboue the beginning of the spinall marrow. Out of the lower and forward angle of this passage,as soon as it is gotten vnder the testicles,there issueth another passage [Table 11.fig,8. neare to [K]] farre narrower then the former, which pasing slily forward through the substance of the braine, sinketh downeward and determineth in the end[Table 11.fig.8.[L]] of the first passage; out of both which ariseth an orifice [Table 15 figure 20.[D]] which endeth in the *Bason*, and leadeth the phlegme out of the third ventricle. This *Vesalius* taxeth *Galen* for pretermitting,in the place next aboue named. Now whereas at the second passage there appeareth a certaine slitte or cleft, *Columbus* will needs liken the same vnto the lap or priuity of a woman.

Second.

Another passage.

Vesalius taxeth *Galen.*

The vse of the third ventricle is to be a receptacle of the Animall spirit, which also is by Nature so quaintly formed(for *Archangelus* referreth all those resemblances of the arch,the buttocks,the testicles,the fundament, the womans lap and the yarde vnto the third ventricle) that it driueth them into the fourth ventricle.

The vse of the 3. ventricle.

Aboue this third ventricle lyeth the *Fornix* or Arch called καμάρων ἢ θαλλοειδὲς, because in forme and vse it resembleth a crosse vault or arch. *Columbus* calleth it *Corpus cameratum* The vaulted body,which(saith he)is supported with 3. pillers. This arch is but one and lyeth vnder the Callous body almost in the middle of the braine but a little backward, and swelleth equally out of both sides thereof: for it is common to both sides of the brain. It groweth out of the backe part of the two vpper ventricles [Table 9. figu. 4. the vpper [LM] Table 10.fig.5.ST figure 6.[Bc]] where they bow forward. VVhilest it is contayned within the brain it is a long and callous body,yet broader toward the backpart, but as it creepeth forward it groweth sharpe to his very end.[Table 10.fig.5.from [S T] to [V] fig.6.from [Bc] to the vpper [A].] At that forward sharpe end [tab.10.fig.6. at [F]] it is againe ioyned to the substance of the braine as also to the callous body;but in the middest and in the rest of his bredth it is free and at liberty [tab.10.fig.5.[XX].]

The *Fornix* or arch.

His names.

And delineation.

The figure of it is Triangular but consisting of vnequall sides,so sayth *Galen* in his eight booke of the *Vse of parts* and the 11. Chapter. *Vesalius* and *Laurentius* call it *semicircular*,or rather like a bridge whose backpart standeth vpon two knees, the forward vpon one. For first in the backpart it reacheth from one of the ventricles ouer to the other,and that side is short [Table 10.fig5. from [S] to [T] and fig.6.from [B] to [D].] The two other sides are equall and somewhat longer,reaching from the backpart to the forepart [tab.10.fig. 5. from [S] to [V] and frō [T] to [V] fig.6.from [B] to the vpper [A] and from [C] to the vpper [A]] so that backward it hath two Arches and forward one,and standeth like a threefooted stoole vpon the braine.

His figure. *Galen.*

The substance of it is like the substance of the ventricles but somewhat whiter and harder,like the substance of the callous body.It is no where compassed with the *pia mater*,and in the bottome where it archeth ouer the ventricle, it is free and at liberty not tyed to any of the adiacent parts. [Table 10.fig.6.[AAA].] In the sides where it respecteth the two forward ventricles [tab.10.fig.5.at [LM].] it is supported, backeward with two props and forward with one; the superficies of it is smooth and moystned with a wateriſh humor.

Substance.

On the outside neare the originall it is gibbous,embowed [tab.10.fig.5.[SY]]or conuex, and in the originall *orbicular* or round,that without payne (sayth *Galen* in the 8.*de vsu partium* and the 11.) or desease it might sustain the waight of the braine lying vpon it,that the common passage or third ventricle vpon which it coucheth,might be kept open and large and not compressed, because vnder it the two first ventricles do meete.

In the length of it it swelleth a little in the middest like a broade line [table 10.figure 5. [XX]] by which it is continued with the partition of the ventricles called *septum lucidum*.

VVithin it is hollow [Table 10.fig.6.[AA]] as well for the free passage of the spirits, as also that the vessell [table 10.fig.6.[K I] table 11.fig.7.[V] arising from [T]] arising out of the fourth *Sinus* of the *Dura mater* and deuided into the two forward ventricles, might passe vnder it and not be pressed by the substance of the braine hanging ouer it. And thus much of the arch.

The

Table 10. *Figure* 5. *ſheweth the ſame that the former Table did, ſauing that the Callous body in the foreſide ſeparated from the Braine and reflected backward, and torne from that partition which diſtinguiſheth the ventricles, is heere more manifeſtly to bee perceiued, together with the Fornix or Arch of the Braine.*

Figure 6. *ſheweth the Arch looſned on the foreſide and drawne backward, that the lower part and the veſſels might better be ſeene.*

TABVLA. X.

FIG. V.

VI

Figure 5.

RRR, The lower *ſuperficies* of the callous body reflected.

STV, The *triangular* ſurface of the *Fornix* or Arch.

XX, The lower part of the partition of the ventricles continuated with the Arch.

YY, The vpper part of the partition continued with the callous body.

Figure 6.

AAA, The lower ſurface of the Arch.

BC, Two corners of the Arch by which it is continuated with the ventricles.

DE, The right and left ventricles.

FG, Arteries climbing vp from the ſleepy arteries thorough the lower ſide of the ventricles for the forming of that complication of veſſelles which is called *Plexus choroides*.

H, A veſſel iſſuing out of the 4. *Sinus* vnder the Arch & paſſing into the third ventricle.

IKL, The diuiſion of this veſſell, a part whereof goeth to the right ventricle at *K* and another to the left at *L*.

MN, The *Plexus choroides* made of the artery FG and the veſſell H.

OO, Small veines paſſing thorough the ventricles of the braine produced from the veſſels K and L.

P, Other veines ariſing from the ſame, diſperſed without the ventricles into the *pia mater*.

Q a paſſage from the third ventricle vnto the *Baſon or Tunnell*.

RS, Canales or *Sinus* grauen or furrowed in the ſubſtance of the ventricles in which the phlegme is led along to the orifice of the foreſaid paſſage marked with Q.

The *Plexus Choroides*.

The names.

The *Plexus Choroides* hath his ſcituation in the forward ventricles [Table 13. figure 13. ♂] betwixt them and the Arch, they are called χοροειδὴ πλέγματα, becauſe they are like the χωρίον that is, the After-birth or membrane which compaſſeth the Infant. But by all Anatomiſts they are called *Plexus Chore formes* or *Reticulares*.

What it is.

They are complications of ſmall veſſels in the ventricles of the brain compaſſed with the *pia mater* [Table 9, fig. 4.°° table 10, fig. 5.°° fig. 6.ᴹᴺ.]

Diuers deſcriptions thereof.

How and of what veſſels they are made is diuerſly ſet downe by the Authours of Anatomy, and becauſe it is a ſpeciall matter and of ſubtile conuayance, I will not ſpare my labour to ſet downe the diuers delineations of *Archangelus*, *Laurentius*, *Veſalius*, *Fallopius*, and *Bauhine*.

Ar-

Table II. *Figure 7. sheweth the Brain, wherein that part is taken away which made the vpper ventricles and did lie vppon the* Cerebellum: *here also the vessell led along from the fourth Sinus, is separated from the* Plexus Choroides *& so eleuated, that the third ventricle, the Sinus of the* Dura Meninx, *and the After-braine it selfe may better be descerned.*

Figure 8. sheweth the Braine yet further dissected and more of it taken away, so that the Testicles are diuided that you may see the passage of the third ventricle into the fourth, and the Cerebellum *vncouered from the thick membrane.*

TABVLA. XI.

FIG. VII

AABB, Portions of the braine remaining yet in the skull,
CCC, The lines of the conuolutions of the braine toward the Basis thereof.
DD, the Barke of the braine.
EEE, the white marrow of the brain circumscribed with lines.
FG, Parts of the sleepy arteries.
H, the lower side of the third ventricle distended.
I, the *anterior* hole of the third vētricle which goeth into the Tunnell.
K, The *posterior* hole of the third ventricle which goeth vnto the fourth.
L, the pine-glandule vppon which lyeth the venall vessell marked with V when it is in his proper scituation.
MN, the Buttocks and Testicles of the brain.
OO, A processe of the *Dura Meninx* betwixt the braine and the after-braine.
PPQQ the first & second *Sinus* of the *Dura Meninx*.
R, the Presse of the braine called *Torcular*, or the congression and meeting together of the foure *Sinus*.
S, the beginning of the third *Sinus*.
T, the fourth *Sinus* opened,
V, a reflected and broken vessel of the fourth *Sinus* which runneth into the ventricles.
XX, the *Cerebellum*, or After-brain couered with the *pia mater* or thin membrane.
Y, A passage from the fourth *Sinus* into the thin membrane where it couereth the after braine and the testicles.
ZZ, the connexion of the thick membrane or *Dura Meninx* with the stony-bone, which contayneth the organs of hearing.

Figure 8.

AABB, That part of the braine which remayneth,
CDE, the lines, the barke and the marrow of the braine,
FG, Portions of the sleepy arteries,
H, the forepart of the third ventricle,
I, the hole vnto the Tunnel or Bason,
K, Another hole from the passage L deriued to the first hole I,
L, the backpart of the third ventricle descending to the fourth.
M, the Pine-glandule depressed toward the side.
NOPQ the testicles and buttocks of the braine.
RR, the *Cerebellū* couered with the *pia mater*,
SS, Certaine vesselles which do compasse the *pia mater* and do afford small branches
TT, to the sleepy arteries,
V V, the thicke *meninx* which did inuest the *Cerebellum*,
xx, vessels from the *Dura meninx* sprinkled into the *tenuis*
zz, the cōnexiō of the *dura meninx* to the skul.

Archangelus thus: It is made of arteries (to which no veines are ioyned) creeping vp into the ventricles through the inside of the braine from that admirable net or complication seated in the *saddle* of the wedge-bone. *Archangelus.*

Laurentius thus: It is a mazey laberynth of small veines and arteries running through the parts of the *pia mater* as it riseth vpward. *Laurentius.*

Vesalius and with him *Platerus* thus: It is wouen of a braunch of the fourth artery, and of *Vesalius & Platerus.*

of the vessels proceeding out of the fourth *Sinus* of the *dura Mater*, and of the *Pia Mater*, and a duskish kinde of flesh.

Fallopius. *Fallopius* in his Institutions more particularly thus. It is made of Arteries onely without any admixtion of Veines, partly of the Soporary Artery which also maketh the *rete mirabile* or wonderful Net, partly of Arteries which ascend through the transuerse processes of the Necke and go into the Braine by that large hole whereout the spinall marrow yssueth; and are led vnder the Basis of the braine, and do degenerate into Vessells like Veines, which vniting themselues into one braunch doe approach forward to that place where the wonderfull Net is made by those soporarie Arteries, and being vnited with these do make the *Plexus choroides* which passeth through all the foure Ventricles, & as it passeth thorough the third Ventricle when it commeth to the fourth *Sinus* of the *Dura Mater* it is ioyned thereto by certaine small and slender branches.

Bauhine. *Bauhine* yet more particularly thus. It is wouen of vessels which arriue at the Ventricles partly running from the fourth *Sinus* of the *Dura Mater*, partly of Arteries arising other-whence. For from the end of the fourth *sinus* of the *Dura Mater* [Tab.13,Fig. 13,^{K}] is formed a venall Vessell, [Tab.13,Fig.13,^{i}] which running through the middle ventricle is led along in the forward Ventricles. [Ta.13,Fig.13,^{lm}] So also another of a branch of the fourth *sinus* which goeth downeward and forward to the vpper Ventricles [Tab. 13, Fig. 13,^{g}] And another of a branch of the fourth Artery of the Braine which passeth into the Ventricles. [Tab.13,Fig. 13,^{A}] All these Vessels are accompanied with a portion of the *Pia Mater* which embraceth them and knitteth them together; a reddish Flesh or Glandulous substance being scattered betweene them: which Vessels, Membrane and Flesh make the *Plexus Choroides*. This Webbe or complication ariseth from the Lower part of the Ventricle to the backe part of the Ventricles, and so passeth on till it meete with that Venall vessell [Tab.13,Fig.13, from ^{i} to ^{K}] brought from the fourth *sinus* foreward thorough the third Ventricle where they ioyne together, and then it distributeth small branches through the substance of the Ventricles [Tab.10,Fig.6. from ^{F} to ^{G} to ^{MN} after to ^{KL}, then from ^{i} to H. Tab.13,fig.13, from ^{A} to ^{fi}]

The vse of the Plexus Choroides. In these complications are the Animall spirits concocted, attenuated and prepared, *Columbus* (as he is alwaies his owne friend) brags that hee first found out the generation of the Animal spirits in this web: but *Archangelus* gaynsayeth him and quoteth *Galen* wher he maketh mention of the same. He also thinketh that the Animall spirit is but inchoated in the *Rete mirabile* and perfected and absolued in this complication: but the power whereby it is perfected is from the substance of the Marrow of the Braine it selfe. And then that they are powred out from this *Plexus* into the forward Ventricles, and thence into the Organes of the senses. *Platerus* cannot admit of this vse of the Plexus, but saith, that becaus the inner substance of the Braine hath no such complications or gyrations as the outward hath, or vessels deriued vnto it; these Vessells were by Nature ordained in the center therof, that by them it might receiue vital spirit and a proportion of blood, that as the outsides had aboundance, so the inside might not bee altogether destitute of life and nourishment. And thus farre of the *Plexus Choroides*.

Platerus his conceit of the vse of it.

CHAP. XII. *Of the Glandule called* Pinealis, *the Buttockes, the Testicles and the fourth Ventricle of the Braine.*

The Pine. glandule. IN the third Ventricle at the entrance into the fourth, [Tab.11,figure 7^{K}] there is seated a Glandule or Kernell, [Tab.11,Fig 7,^{l}.fig.8,^{M}. Table 12 fig.10,H] resting vpon the foreside of the Testicles, [Table. 11,fig.7,^{MN}] Tab. 12,fig.10,^{EP}] and lyeth vnder the Venall vessel [Tab.10,fig.6,H,I. Tab.11,Sig.7,^{V}. Tab.12,fig: 10,^{r}] which springeth out of the fourth *Sinus*, with which vessell also in Dissection it is easily drawne away from the Braine, for in men it scarse cleaueth to the substance of the Braine, but in a Sheep or Calfe it is continuall after a manner with the substance of the Braine: also in Beasts it is much larger then in men, yea not onely this Glandule but all the other partes and particles of the Braine are farre larger and more conspicuous in bruite beasts then they are in men: and therefore it is fit that yong men should bee initiated and exercised in cutting vp the braines of a Calfe or such like, that when they come to dissect a man they may not be too farre to seeke.

Calfes heads fit to cut vp.

The Figure of it is like a Cone, that is a round turbinated figure, much like the fruit of

Table 12. *Figure* 9. *Sheweth the* Cerebellum *drawne a little out of the skull aboue the Braine, that the lower surface thereof and the cauity of the spinall Marrow might better bee discerned.*

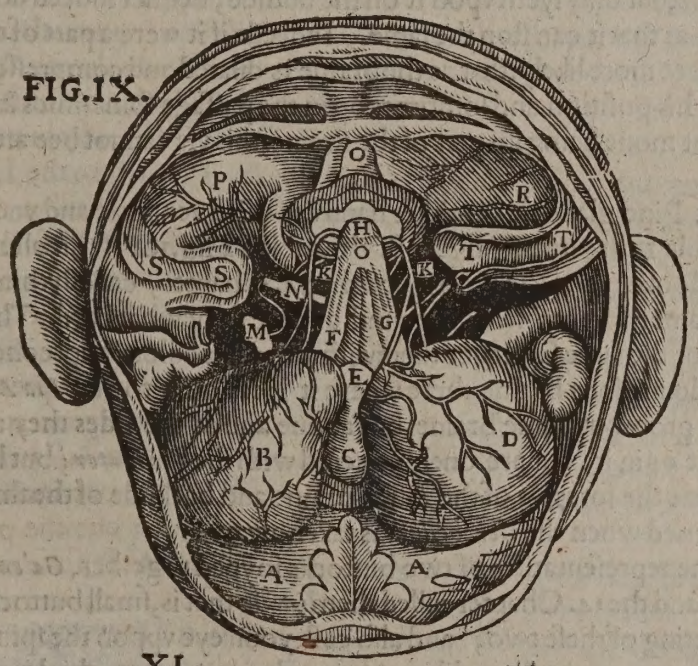
Figure 10. *Wherein is shewed a portion of the Braine from which the spinall Marrow taketh his beginning, together with the Testicles, the Buttocke, the Pine-glandule and the fourth Ventricle.*

Figure 11. *Sheweth a part of the Skull couered with the* Dura Meninx, *through which the opticke Nerues, the Bason and the sleepy Arteries do passe.*

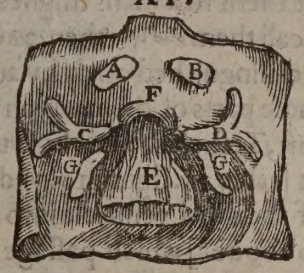
Figure 12. *Sheweth the Bason or Tunnell lifted vp, and 4. passages which leade the Phlegmatick excrements of the Brain from the glandule or kernell.*

TABVLA. XII.

FIG. IX.



XI.



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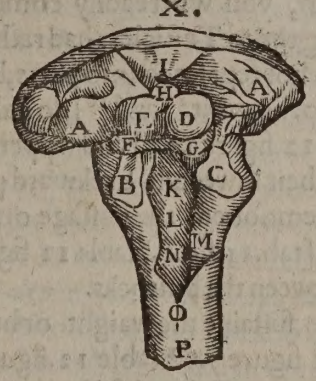


XII.

AA, a part of the Braine left in the skull.
BCD, Three parts of the *Cerebellum* reflected, incompassed with the *Pia mater* and growing to the marrow of the backe.
E, The hindermost processe like to a worme called *vermi-formis*.
FGH, the beginning of the spinall marrow falling out of the skull to H.
I, the greater part of the 4. ventricle which is excauated or hollowed in the marrow of the backe.
K, Vesselles deriued to the *Cerebellum* from those vessels which are emptied into the first and second *Sinus*.
L, other vessels from the *dura meninx*, sprinkled into the *pia mater*.
MN, the fift and sixt coniugation of nerues.
O, the toppe of the fourth ventricle like the neb of a quill.
PQR, The backeward bosome of the skull made to receiue the *Cerebellum*, which bosome is yet couered ouer with the *Dura meninx*.
SS TT, the first and second *Sinus* of the *dura mater*.

Figure 10.

AA, Parts of the spinall marrow cutte from the braine.
BC, the places where this marrow did grow vnto the braine.
DE, the Testicles. FG, the buttocks, H, the pine-glandule.
From I to K, a part of the third ventricle going to the fourth, vnder the Testicles.
KLMN, A part of the fourth ventricle which is engrauen in the marrow.
O, the top of the fourth ventricle.
P, the place where the spinall marrow goeth out of the skull.

Figure 11.

AB. Parts of the optick nerues.
CD, the sleepy arteries. *E*, the *Bason* or Tunnell hanging downe.
F, A hole or perforation of the *Dura meninx*, through which the Tunnell reacheth vnto the glandule.
GG, parts of the second coniugation of sinnewes.

Figure 12.

A, The Glandule. *B*, The *Bason* or Tunnell called *Peluis* or *Infundibulum*.
CDEF, the foure holes thorough which the phlegmatick excrement issueth.

a Pine-apple, broade and round in the Basis, and growne smaller but keeping round to the top; and hereupon it is that it is called κωνάριον, and *Glandula Pinealis*: some haue resembled it to the end of the Virile member, and therfore call it *penis Cerebri*, the yarde of the brain. Somewhat long it is, and the Basis sayth *Vesalius* resteth vpon the substance of the braine, but the top regardeth vpward.

The

Substance. The substance of it is somewhat hard, rather sayeth *Vesalius* inclining vnto the nature of a glandule then of the Braine, and couered with the thinne membrane. The colour of it somewhat differeth from that of the marrow, as being a little yellowish. It lyeth vnder the vessell sayth *Bauhine* [Table 10. fig. 6 H] which goeth to the third ventricle, from which vessell all the webs almost which are in the ventricles doe proceede: and hath the same vse that other glandules haue, which are placed vnder vessels, that is, to confirm their diuisions. For as soone as this vessell entreth into the third ventricle, it is presently diuided into many branches couered ouer with the *Pia Mater*; and therefore the glandule becommeth to them a strength and stay; but *Archangelus* denyeth this vse of it. Againe, it hath another vse acknowledged by *Vesalius*, *Platerus* and *Laurentius*, and that is to keep the passage of the third ventricle open that it bee not stopped by the ingate of the fore named vessell, and so the Animall spirit hindered from descending into the fourth ventricle.

Vse.

Archangelus his conceit. *Archangelus* obseruing that this glandule was placed at the beginning of the middle or third ventricle, out of which the spirit is transmitted into the ventricle of the after-braine, thought that this glandule had the same vse that the *Pylorus* of the stomacke hath, to be a Porter as *Galen* saith to moderate the outgate of the spirits. But the the trueth is, that this Glandule can haue no such vse becaus it is no particle of the Braine, neither adhereth to the inward sides of the ventricle, but only lyeth vpon it on the outside; neither indeed doth it so nearely touch the passage as that it can stop the same. Indeede if it were a part of the brane (sayeth *Galen*) then it were more likely, that as the braine is dilated and compressed, the Glandule also should alter his position and somtimes open the passage sometimes shut it, but seeing of it selfe it cannot moue being no part of the Braine, this vse cannot bee attributed vnto it.

Disproued.

The Testicles and Buttocks. Vnto the backeside of the Pine-glandule on either hand the third ventricle and vnder the Arch doe leane foure [Table 11. figure 7.^{MN} figure 8.^{NOPQ}, table 12 fig. 10.^{EDFG}] small bodies, which *Galen* in his eight Booke of the *Vse of Parts* and the 14. Chapter, calleth thinne and long eminencies of the braine, for they swell vp round and are somewhat hard. They are particles of the Brain and of the same substance therewith, but their colour approcheth nearer sayth *Vesalius* to the colour of the Braine there where it lyeth next to the *Pia Meninx*. In their lower part they grow out of the Braine, but aboue and at the sides they are not continued to any part of it or in it, but are onely couered with the *Pia mater*; but because they are scituate betweene the forepart of the After-braine and backside of the third ventricle they are better descerned when the *Cerebellum* is taken away.

And because they carry the representation of two buttocks ioyned together, *Galen* in his 8. Book of the *Vse of Parts* and the 14. Chapter called them γλουτία that is, small buttocks; and if you marke well the meeting of these two, and also cast your eye vppon the spinall marrow that descendeth by them, you will readily compare them to a mans thighes set close together. Others comparing thē to Testicles, had rather call them διδυμα then γλουτία. Others, because these bodies are not separated into parts, but distinguished onely by an ouerthwart line [table 12. figure 10. betwixt^{ED} and^{FG}] do call those parts of them which are next to the Pine-Glandule [table 12. figure 10.^{N}] and vppermost, Testicles, and those that are lower, Buttocks: because in their lower and backward part [table 12. figure 10. vnder^{F} and^{G}] when the After-braine is remooued, the passage out of the third ventricle into the fourth conspicuously appeareth [tab. 11. fig. 8.^{K} table 12. fig. 10 aboue^{K}] which passage resembleth the very fundament between the buttocks.

Their vse. The vse of these bodies is to sustaine the waight or bulke of the braine, least the third ventricle or the passage [table 11. figure 7. 8.^{K} table 12. figu. 10.^{IK}] which goeth out of the third into the fourth should be compressed, and so the Animall spirit intercepted. Some thinke that these particles driue foreward the Pine-glandule to shutte vp the passage of the ventricle: and *Archangelus* thus. The Testicles thrust forward the Gladule, and the Buttockes thrust forward the Testicles: for if you deuide these particles and enter a Probe at the backe hole of the third ventricle, you shall more plainly perceiue the other part of the third ventricle scituated vnder the Testicles [Tab. 12. figure 10.^{I} and^{K} shew the whole third ventricle] which endeth into the fourth.

The fourth ventricle. The left ventricle which *Galen* in his 8. Booke of the *Vse of Parts* and the 12. Chapter, calleth the ventricle of the *Cerebellum*: *Laurentius sinus quartus* the Common Anatomists the fourth ventricle [table 12. fig. 9.^{I} fig. 10.^{IMNO} with table 15. fig. 21. H] is scituate betwixt the After braine and the spinall marrow for it is common to them both: so sayth *Vesalius*

It

It is compounded of the hollownesses of the *Cerebellum* and the Marrow of the backe, no otherwise then if you ioyne both your hands together and make one hollownes between them, or as *Fallopius* hath it in his Institutions. It is scituate in the back part of the Braine, betweene it and the *Cerebellum* where the beginning of the spinall Marrowe ariseth out of the braine, for in it it is for the most part formed. It is the least and the finest of all the Ventricles: the figure of it is round, but withall somewhat long after the fashion of an Egge. At the first it beginneth somewhat large and by degrees is straightned till at length it end in a sharpe corner. For the lower and chiefe cauity of this ventricle is in the spinall Marrow [Tab. 12, fig. 10, from ˣ to °] hauing a hollownesse like a slit, which sinus *Herophylus* likened to the cauity of a writing pen, the end of it which is resembled to the neb of the pen arising on eyther side [Tab. 12, fig. 10, ᴺ] like a wing. The vpper part of it is made of the After-brain and the *pia Mater* encompassing it. [Tab. 15, fig. 21 H] For this Ventricle is lined with the *pia Mater*, before [Tab. 11, fig. 7, ᵒᵒ. neere to ᴹ ᴺ] where it ioyneth the *Cerebellum* to the Braine and to his buttockes, behind [Tab. 11, fig. 8. as it were ioyning ᴱ to ᴴ] where it ioyneth the *Cerebellum* to the spinall Marrow.

The Figure.

Calamus scriptorius.

This Ventricle is not double but single, because out of it the Spinall Marrowe was to be produced as *Galen* saith: now the Spinall Marrow is single, for it had not beene possible, or if possible, it had not beene fit that one Creature should haue hadde a double Spine. The magnitude therof is conuenient to receyue the Animal spirits out of the forward Ventricles by the common passage or third ventricle and to communicate them to the Nerues which vnder the head are distributed into the whole bodie, whence it was that *Herophylus* called this Ventricle *Principalissimum*, the most principall. Yet it is lesse then the forward Ventricles, because (sayth *Galen*) it conteyneth a thing of more power and Faculty. In this ventricle *Vesalius* thought was the seate of the Memorie, but wee knowe and are able to demonstrate that no cauity of the bodye is the seate either of the sensatiue soule or of any of her Faculties, but rather the solid substance of the parts.

The magnitude.

Herophylus.

The vse of it.

Vesalius his conceite disproued.

This Ventricle we finde in Dissections (as also al the rest) to conteine in it a watersh moysture. The two forward beside this water conteyne also the *Plexus Choroides* [Tab. 9. fig. 4. OO. Ta. 10, fig. 5, OO. fig. 6, ᴹ ᴺ] and the third the Venal Vessel [Ta. 10, fig. 6, H, I. Tab. 11. fig. 7, ʸ brought out of ᵀ] which is propagated from the fourth *sinus* of the *dura Meninx*, and maketh the *plexus* as we saide before more complicated. Many there are who thinke that all these foure Ventricles do conteine the Animal spirits laboured and perfected in the *plexus Choroides*.

What euery one of the Ventricles conteine.

CHAP. XIII. *Of the Tunnel, the Flegmaticke* Glandule, *the wonderfull Net, and the vse of the Braine.*

AT the first or forward hole of the third Ventricle, or at the sides of that hole or orifice [Tab. 11, fig. 7, and 8 I] we meet with a deepe cauity ioyned aboue to the Braine and made (as saith *Galen* in his ninth booke of the Vse of parts and the third chapter) of the *pia mater* compassing the basis of the Braine. For of this *pia mater* lengthned out is made a round processe or production, [Tab. 15. fig. 20. ᶜᶜ] whose beginning is large and ample, [Tab. 12, fig. 11, ᴱ fig. 12, ᴮ] but after is straightned into a pipe till it end in a long Fistule or quill (wouen with small but many veines) which through a proper hole [Tab. 12. fig. 11, ᴱ] made for it in the *Dura mater* descendeth and determineth into the Pine-Glandule. This passage by *Galen* in his ninth Books of the Vse of parts and of Anatomicall Administrations and the third Chapters, as also by many that haue followed him, is called πυελὸς *peluis* the *Bason*. He calleth it also in the place before named χοάνη *Infundibulum* the Tunnell, because in the top it serueth as a Tunnels top to admit the Humor, and in the bottome like the pipe to let it out; for by this the thicker excrements of the Braine stored vp in the ventricles are receiued and transmitted to the Flegmaticke Glandule of which we shall speake by and by. *Vesalius* maketh the vpper part to be called πυελὸς, and compareth it to a Bathing tub such as they vse in Hot houses. The neather part χοάνη, which cannot be better compared then to the pipe of a Tunnell such as they tun Beere with.

The Tunnell.

His Names.

Vesalius.

Concerning the vse all Anatomists do agree; but *Laurentius* me-thinkes for the fashion and the vse compareth it best to such a bagge as wee call *Manica Hippocratis* in English commonly an *Hippoccas* bagge, because through it they run; *Hippoccas* which is called *Hip*, wine. Next to the bason followeth the flegmatick Glandule. *Galen* in his 9. book *de vsu par-*

Glandula pituitaria.

partium and the third Chapter calleth it simply ἀδήν, that is, a Glandule. The seate of it is vnder and without the Meninges at the end of the Tunnell in the saddle of the wedge-bone. For this saddle or bosome of the bone was purposely made to receiue this Glandule: and therefore the forme of them both differeth little; for it is flat hollow aboue, gibbous below and almost foure square. The substance is Glandulous, but yet more compact and harder then other glandules. Thicke it is and compassed about with the *Pia mater* haply with that part thereof which maketh the Tunnell, and by this Membrane it is tyed to the bone and leaneth to two branches of the *soporary* Arteries called *Carotides* which creepe vp by the sides thereof. [Table 12, fig. 12. CDEF] This Glandule receiueth the excrements in manner of a sponge as they fall from the braine, which excrement it not onely emptieth into the palate, but also some fals downe by his sides through those holes which are bored in the Basis of the Scul. Neyther was *Hippoc.* ignorant hereof, who in his books *de Glandulis* & *de locis* in *omine* saith, that *Humors fal out of the head through the eares, the eies, the nose; others by the Pallat into the throat & the gullet, some also through the veins into the spinal marrow and into the bloud: that is 7. wayes.* For at the sides of this Glandule there are bored two holes in the bōe which descēd, one forward ending in that hole where through the 2. payre of sinewes is led, the other descendeth more backward and passeth by the sharp Cleft at the sides of that hole through which that notable branch of the *soporary* Artery ascendeth into the Scull, of which outlets we shall speake more at large in the History of the bones.

His substance

Vse.

Hippocrates.

And these are the wayes by which the phelgme is euacuated out of the braine. For the braine being great and large stood in need of much aliment, and because it is very moist & not very hot out of that much aliment many excrements do arise & are gathered therein; which excrements being of two kindes thinne and thicke, the thin do vapour out through the Sutures, the thicke are euacuated partly by the Nostrils as we haue saide already, partly by the Palate. For those that arise aboue the Ventricles and are stabled in the diuision of the braine are purged by the foreward hole and the Nose, and is called *Mucus*; we giue it a homely name but proper to it, and call it Snot.

But those that are gathered in the ventricles do most what descend to the Tunnell and are auoided by the Palate, eyther by simple spitting which we call Rheume, or else by excreation or hawking which we cal phelgme. And thus much of the Glandule & vse therof.

Wonderful Net.

The *Rete mirabile* or wonderfull Net which *Galen* (in the 9. booke of the *Vse of parts* & the third chapter) calleth, δικτυοειδὲς πλέγμα, [Tab. 13, fig. 14,] that is, the Net like complication, hath his name from the artificiall figure; for it is made of the soporary arteries, [tab. 13, fig. 14. AB] which arising vpward from the heart through the Chest climbe vnto the head and at the Basis of the Brayne neere the originall of the opticke Nerues, do make this web or Net. This net compasseth the glandule [Tab. 13, fig. 14, E] at the sides of the saddle of the wedge-bone, and is not like a simple Net, but as if you should lay many fishers Nets one aboue another; wherein this is admirable, that the replications of one are tyed to the replications of another so that you cannot separate the Nets asunder, but they are all of them so wrought into one another as if it were a bodye of Net meshed together not into breadth onely, but euen into thickenesse also. In these according to *Galen*, the Animall spirits make long stay; which haue for this proper and immediate matter the vitall spirits raised vp in the arteries and heere wrought into Animall, from whence they are conueyed into the ventricles of the braine. For saith *Galen* (in his 9. booke of the *Vse of parts* and the fourth chapter) where Nature intendeth exactly to forme any thing she prouideth that it shall remaine some good space in the instruments of concoction. Some are of opinion that the vitall spirits are prepared in these small arteries, and some (*Archangelus* for instāce) that the Animall spirits are inchoated heere and perfected in the *Plexus Choroides*, that hauing receiued their power and efficacy from the Braine & the marrow thereof, they might yssue into the ventricles and there be stored vp for vse.

Wherof made

The vse of it.

Vesalius affirmeth that this wonderfull Net is onely found in the heads of beasts, but we, saith *Bauhine*, haue beene able to make demonstration of it in all the mens heads we haue hitherto cut vp, although we confesse that in Calues and Oxen it is much greater & more conspicuous. Now these three particles, the Tunnell, the Glandule and the Net cannot be demonstrated before the substance of the After-braine be taken away; and the 2. latter not before the *Dura meninx* be dissected. Finally, before you make demonstration of these three, you must shew the spectators the Mamillary processes and the payres or coniugations of the sinewes, which otherwise in the search for these will be defaced.

Bauhine. Vesalius.

The way how to demōstrate these parts.

The

Table. 13. *Figure* 13 *exhibiteth the vesselles of the Braine and their distribution, especially through the right side, whither they proceede from the internall Iugular veine, or from the sleepie Arterie, or from the* sinus *of the* Dura Meninx.

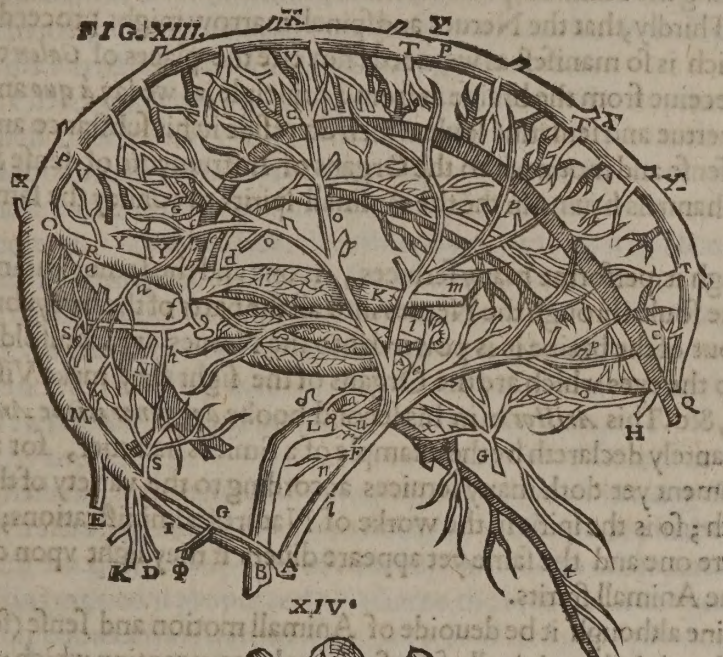
Figure, 14. *sheweth the wonderful Net as Galen describeth it.*

Figure 15. *sheweth the pituitary Glandule with the Bason and the sleepy Arteries.*

Figure 16. *sheweth the* Rete-mirabile *or wonderfull Net, together with the glandule as it is found in the heads of Calues and Oxen.*

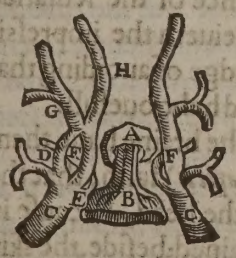
TABVLA XIII.

FIG. XIII.



XIV.

XV



XVI.

A. The internall Iugular veine.
B. The sleepy or Iugular artery.
C. the first veine.
D. the 2 veine which is led vnto the *Sinus*.
E, the 3, creeping through the *dura meninx*
F, the fourth running into the *Sinus*.
G H, the 5 and 6 going to the *dura meninx*.
I, the first Artery.
Φ. A braunch of the same Artery running through the Muscles of the necke.
K, the second artery reching into the *sinus*
L, the third without a companion.
r A small branch of the third Artery.
M, N, the 1 & 2 *sinus* of the *Dura Meninx*.
O, the congresse or meeting of both those *sinus*. PP, the 3 *sinus* of the *Dura Meninx*
Q. The end thereof.
R, the fourth *sinus* of the *Dura meninx*.
SS, Branches of the first *Sinus* deriued into the Membranes neere at hand.
TTTT, Branches of the third *Sinus* dispersed into the *Pia Meninx*.
V V, the lower smal branches of the 3. *sinus*
X X, the vpper, distributed through the *Dura meninx*.
Y Y, certain surcles of the 4 *Sinus* sent vpward. *aa*, Others sent downward.
b, the vpper passage of the fourth *Sinus* running by the *Syth*.
cc, Surcles runing vpward from this passage
de, the right & left vpper branches of the fourth *Sinus*. *f*, The lower branch going to the *Pia mater*.
g, A branch of the same pas. going forward
h, The same bending backewarde to the *Choroides* reflected to the *Cerebellum*.
i, A notable vessell into the which the 4. *Sinus* doth determine.
K the vpper. The by-partition of this vessel in the braine.
l, *m*, Two branches of this by-partition.
n. A surcle reching to the organ of hearing
ooo, the distribution of the 3 vein & artery,
ppp, Surcles proceeding from the Brãches marked with *o* deriued into the *pia mater*
q, The diuision of the third artery where it entreth into the scull. *s*. A braunch reaching to the hollownes of the nostrils
t, the end of this in the extreamity of the vessel. *uu*, 2 branches entring into the scul
x. A branch deriued vnto the eie from the coition or meeting of the branches *uu*,
e, A branch attaining to the *pia mater*.
A, A brãch attaining to the right ventricle
The complication of vessels called *Plexus Choroides* formed on either side of the the scull, and making this wonderful net.

branch marked with A. *Fig.* 14, A, B, Arteries climbing. C, D, Branches into which the surcles of that ner are ioyned in to E, the pituitary glandule or kernel of flegm *Fig*: 15. A, the Glandule receiuing the bason. B, the bason it selfe, or if you wil, the Tunnel called *Peluis* or *infundibulum*. CC, the sleepy Arteries. D, A branch of the artery going to the side of the *Dura Meninx*. E, Another branch of the same artery going to the nostrils. FF, An artery in one side diuided into 2 branches, but in the other side meeting togither againe. G, A partition of the artery creeping through the *dura meninx*, H, Another branch which getteth out of the scull and reacheth to the eies. *Figure* 16, A The petuitary Glandule. B, C. The sleepye arteries going into the scull. D, D. The wonderfull Net.

For the vse of the Braine. Aristotle (in his second booke *de partibus Animalium* and the 7. chapter) writeth, that the braine was made as a commõ good for the behoofe of the whole Creature, to temper the feruour and heate of the heart; which opinion because it is sufficiently refuted by *Galen* in his 8. booke of the *Vse of parts* and the second chapter wee wil not The vse of the Braine.

inſiſt long vpon it, only theſe two things we open. Firſt, that the heart is ſufficiently refrigerated by our perpetuall inſpiration and expiration. Secondly, that if Nature had intended the brayne to coole the heart, ſhe would not haue ſet them ſo farre diſtant, but placed it eyther about the heart or at leaſt in the Cheſt: as well therefore might he haue ſaide that the Heele was made for the vſe of the heart as the Braine.

Diuerſe

Wherefore we determine the vſe of the braine to be, firſt for a habitation for the ſoule whereby ſhe performeth her Animall functions, as well thoſe that are principall as alſo thoſe of ſenſe and motion. Secondly, that in the ſubſtance thereof the Animall ſpirits might bee laboured, therein conueyed and from thence deriued into the body. For ſo

Galen.

ſaith *Galen* (in his 8. booke of the *Vſe of parts* and the 13. chapter, and the 9. booke and the 4. chapter.) In the whole ſubſtance of the body of the Braine is the Animal ſpirit wrought and reſerued, not onely in the ventricles: and in his 12. booke of Method the 5. chapter & the third *de locis affectis* and the 7. ſpeaking of the falling ſickneſſe he ſaith, It is cauſed in the braine, the humor hindering the Animall ſpirits which are contained in the ventricles that they cannot yſſue out. Thirdly, that the Nerues and ſpinall marrow might proceede from the marrow thereof, which is ſo manifeſt as we neede not cite the places of *Galen* to proue it. For the Nerues receiue from the braine as from a principle, as we ſay *á quo* and of diſpenſation, the Animal vertue and ſenſatiue ſoule which do reſide in his ſubſtance and do diſtribute the faculties of ſenſe and motion into the Organs or Inſtruments of ſenſe & motion as it were through Channels hauing in thē the Animall ſpirits to conuey the ſame faculties.

The Animall ſpirit.

This Animall ſpirit although it performe many ſeruices, is one and the ſame; leading all the faculties of the ſenſatiue ſoule through the Nerues into all the parts of the body: but the Inſtruments into which out of the braine it is powred into the Nerues are manifolde. Wherefore if they runne into the eyes which are the Organs of the ſight they make Viſion; if into the eares Hearing, &c. This *Ariſtotle* (in his ſecond booke *de generatione Ani-*

Ariſtotles Compariſons.

malium and the laſt text) elegantly declareth by the example of a Smiths hammer, for as the hammer is but one inſtrument yet doth many ſeruices according to the variety of the ſubiect vpon which it worketh; ſo is the ſpirit in the worke of Natures adminiſtrations; & as the beames of the Sunne are one and the ſame yet appeare diuers if they light vpon diuers coulers, ſo is it with the Animall ſpirits.

The ſeate of the ſenſatiue ſoule.

The ſubſtance of the Braine although it be deuoide of Animall motion and ſenſe (for it is not deuoide of Naturall) yet is it the originall of ſenſe and voluntary motion which we may better perceiue if we conſider that diſeaſe which we cal the Apoplexie. For thoſe that are Apoplecticall although all their Inſtruments of the ſenſes are perfect, yet becauſe the Animal ſpirits are intercepted they haue no ſenſe at all. For the originall of the ſpinall marrow being totally ſtopped, all the parts vnder it doe looſe both ſenſe and motion: ſo alſo

Animall motion & ſenſe.

if the Nerue which is conueyed to any part be obſtructed, that part is depriued of ſenſe & motion. Hence it followeth that the braine is the ſeate and reſidence of the ſenſatiue ſoule, and the fountaine of ſenſe and motion. Of ſenſe, becauſe it receiueth the impreſſions of all ſenſible things. Of motion becauſe it diſpenſeth the knowledge of auoiding that which is hurtfull, and deſire to follow after that which is profitable and behoouefull.

Natural ſenſe

As for Natural ſenſe and motion there is a great queſtion whether the braine haue them or no: and firſt for ſenſe. *Hippocrates* (in his booke *de vulneribus capitis*) ſaith, that the braine hath preſent and exquiſite ſenſe about the *Sinciput* or ſides of the head, becauſe in this place the bone is the thinneſt and moſt of the braine is there contained; beſide, the skin of the head is there thinneſt alſo. Moreouer ſaith he, the diſeaſes of the braine are the moſt *acute* and dangerous, yea for the moſt part mortall and hard to be iudged of by thoſe that are not very well experienced.

Galen.

Galen (in his firſt booke of the cauſe of *Symptoms* and the 8. chapter) ſaith, that the braine was not made by Nature an inſtrument with ſenſe, but ſo that it is able to comprehend or perceiue all thoſe things by which it ſuffereth, as if he ſhould haue ſaide, The braine is not made to be a particular inſtrument of ſence, ſo as it can perceiue or apprehend colours onely as the eyes, ſauours onely as the tongue, &c: But it is a common inſtrument of ſenſation diſcerning colours, ſauours, ſmels, ſounds and tactile qualities; and in a word all ſenſible obiects.

Wherefore the braine feeleth vniuerſally whatſoeuer is offered vnto it, not with choice as the eye which receiueth not the ſound but onely his owne obiect and ſo in the reſt. It

remai-

remayneth therefore that the Naturall ſence of the braine is none at all or at leaſt ſo weak and dull as it is hardly perceiued, for in his ſubſtance there is rather a faculty of Touching then an inſtrument of Touch.

Fernelius his Philoſophy about this.

Fernelius thinketh that all motion is from the marrow of the braine, and all ſence from his membranes; becauſe the body of the braine is perpetually moued but hath no feeling at all: on the other ſide, his membranes are of themſelues immouable eſpecially the *Dura mater*, but feele very exactly. So in the Lethargy or Phrenſie which are diſeaſes of the ſubſtance of the braine there is no paine at all, but if a ſharp vapour or humour be raiſed vp vnto the Meninges, then grieuous paine followeth. Moreouer the ſpinall marrow and all the nerues haue their marrow from the braine & that couered with the Meninges, al which haue the ſame and no other power or faculty then what they receiued from their original. wherefore the forepart of the braine is the beginning of Sence, the hinder part of Motion; but of Touching the Meninges or Membranes are the originall. Thoſe nerues which are full of marrow are the inſtruments of Motion; of Touching, thoſe whoſe greater parts are produced by the Meninges. And this is *Fernelius* his Philoſophy concerning this poynt, but how conſonant to reaſon we ſhall ſee afterward.

The motion of the braine.

Concerning the motion of the braine great difference there is among Authors. *Galen* in his 8. booke of the *Vſe of Parts* and the ſecond Chapter, ſayth it hath perpetuall motion.

Veſalius againſt *Galen*.

Veſalius denies it, anſweres his arguments & addeth that he could neuer perceiue any ſuch motion either in great woundes of the head, or which is more in his diſſections of liuing Creatures. *Fallopius* halteth in this poynt, he ſayes it but hee dares not auouch it.

Laurentius.

Platerus thinks that thoſe that ſay it moues, miſtake the motion of the braine for the motion of the third *Sinus*, which beateth like an artery. *Columbus*, *Archangelus* and *Laurentius*, doe all conſent that it moueth continually; and inſtance in woundes of the head. *Laurentius* is ſo confident that he ſayth he is a mad man and wants his ſences that will deny it.

What we reſolue of.

To reſolue vpon ſomewhat among ſo many opinions, we think; that the braine is not moued by any Animall or voluntary motion, but by a Naturall and that double: one proper of his owne, another from the arteries, albeit this laſt *Archangelus* doth deny, becauſe thoſe arteries that runne aboue are too ſmall, but thoſe that are in the bottom of the brain much leſſe, yet it giueth the power of voluntary motion to other parts.

The vſe of the motion.

This motion is proper and peculiar to the braine, for the generation, nouriſhment and expurgation of the Animall ſpirit, for it is dilated and againe conſtringed as may be ſeene in wounds of the head where a notable part of the Scull is taken away, as alſo of the membranes ſayth *Bauhine*.

How the motion is diſcerned.

And in children new borne in the mould, the braine is ſo manifeſtly ſeene to beate and pant, that euen the bones which at that time are very ſoft are mooued therewith. When it is dilated it draweth out of the *Sinus* of the *dura mater* (ſome ſay out of the wonderful net or web of the *ſoporarie* arteries) vitall ſpirits and ayre by the noſthrils, for the reſtauration and preſeruation of the Animall ſpirites, & when it contracteth it ſelfe it driueth out the Animall ſpirits laboured in his ſubſtance through the nerues, as through pipes and canals into the organs of ſence and motion, or as *Archangelus* hath it out of the foreward ventricles being contracted into the third and fourth, and ſo into the organs aforeſaide: which ſpirites when they ariue in the particular parts they nouriſh the Animall ſpirits bred and fixed in thoſe partes.

The Animall ſpirits.

For the Animall ſpirit floweth through the nerues into all the parts, not onely to be the conuayer of the ſenſatiue and mouing Soule, but alſo to giue nouriſhment to the Animall ſpirits fixed in the parts; and this ſpirit is the *medium* or Meane by which the Senſatiue Soule and al his faculties which are incorporeal are ioyned with the body. The outward parts becauſe their inſtruments are farther off, ſtood in neede of nerues as it were Channels through which the Animall ſpirites accompanied by the Vital as it were by guides might be conuaied, but the inward parts becauſe their inſtruments are neare and at hand needed no nerues, but receiue the ſame by blind and inuiſible by-waies yet guided by the ſame Vital ſpirits.

A witty conceit of *Archangelus*.

We haue alſo ſayd that at the entrance into and at the out-gate from the heart there are certain Values or floud-gates ſet, and their vſes wee haue allotted. Now *Archangelus* is of opinion that the Buttocks and Pine-glandule of the Braine doe here the ſame offices that the values did in the heart. For ſayth he, in the dilatation of the braine the way out of the third ventricle into the fourth cloſeth it ſelfe, and beſide is ſhut vp by the glandule falling betweene the Buttocks, that no part of the ſpirits can returne out of the fourth ventricle into the third. On the contrary, in the contraction the glandule is lifted vp and the Buttocks

are diuided, and ſo a way is made for the Animall ſpirit to flow out of the third ventricle into the fourth.

Diuers opinions of the generation of the Animall ſpirits.

Concerning the generation of Animall ſpirits there are diuers opinions; eſpecially ſeauen, one of *Galen*, another of *Veſalius*, a third of *Columbus*, a fourth of *Argenterius*, a fift of *Archangelus*, a ſixt of *Laurentius*, and a ſeaueth of *Varolius*; to which *Bauhine* our author ſubſcribeth.

Galens.

Galens opinion was, that they were made of the vitall ſpirite brought by the *ſoporarie* arteries and of ayre breathed in, mary as for the place of their generation he ſeemeth to be altogether vncertaine; for ſometimes hee aſsigneth the *Plexus Choroides*, ſometimes the ventricles, ſometimes the ſubſtance and body of the braine.

Veſalius.

Veſalius ſayeth they are laboured in the right and left ventricle by a power and efficacy receiued from the brain, and haue for their matter vitall ſpirits from the heart, & aire drawn in by inſpiration aſcending through the third ventricle.

Columbus.

Columbus ſayth they are made of ayre drawne by the noſethrils and altered in the cauities of the forehead bone and the wedge-bone, and carried through the pores of the ſpongy bone to the forward ventricles where it meeteth with the vitall ſpirit ſent vpward from the hart by the *ſoporarie* arteries, & powred into the *Plexus choroides* which is in the ventricles; both which ſpirits and ayre, ſayth he, by the perpetuall motion of the braine and this *Plexus Choroides* are exactly mingled, and of them the Animall ſpirits are generated in that *Plexus Choroides* which is in the ventricles, and this he ſayth was his owne inuention.

Argenterius.

Argenterius will haue but one influent or moouable ſpirite beſides the fixed ſpirites of the particular partes, whoſe arguments ſhall be ſufficiently anſwered in our Controuerſies by *Laurentius*.

Archangelus.

Archangelus opinion is, that the Animall ſpirits are made of the vitall, changed by many exagitations and alterations by the arteries which make the *Rete mirabile* and the *Plexus Choroides*, but receiuing his vttermoſt perfection in and by the ſubſtance of the Braine, & ſo becommeth a conuenient vehicle of the ſenſatiue ſoule. The proceſſe of which generation he ſayth is after this manner. There is an inchoation or beginning made in the *Rete mirabile*, but the plenarie perfection is in the *Plexus Choroides*, yet that from a power or facultie of the marrow of the braine in which alone ſuch power reſideth; being ſo perfected they are powred out into the ventricles (which adde nothing to their generation) as into ſtore-houſes or places of receyte where they are kept to bee tranſported into the whole body.

Laurentius.

Laurentius thus, the Animall ſpirit is generated of the vitall ſpirit and the aire breathed in; whoſe preparation is in the labyrinthian webs of the ſmall arteries, & in the vpper or forward ventricles; but they receiue a farther elaboration in the third ventricle and their perfection in the fourth, and from thence by the nerues are diffuſed into the whole body: but he reprehendeth thoſe that auouch that this ſpirit receiueth his forme and ſpecificall difference in the webs before named.

Varolius. What we reſolue of.

Finally *Varolius* and with him *Bauhine* and wee with them will reſolue, firſt for their matter that it is arterial bloud aboundantly fulfilled with vitall ſpirits and ayre drawn in by the noſethrils; for the manner wee ſay it is thus. The ſpirituous and thin bloud is ſent vp from the heart by the *ſoporarie* arteries vnto the braine, and is powred out into the *Sinus* of the *dura mater* whileſt they are dilated as is venall bloud out of the veins. With this is mingled ayre drawne by inſpiration through the noſethrilles, and ariuing into the braine through the pores of the ſpongy bone. Theſe ſubſtances thus mingled and mixed in the veſſelles, whileſt they are carried through the conuolutions of the Braine are altered and prepared, purged alſo from phlegmatick excrement, which whilſt it nouriſheth the braine, the more ſubtile part is transfuſed into his ſubſtance, and there, that is, in the marrowy ſubſtance of the braine, it is laboured into a moſt ſubtile Animall ſpirite, and ſo is from thence by the ſame paſſages returned and communicated to the ſpinall marrow and to the nerues of the whole body. Neither ſaith *Varolius* is it neceſſary that theſe ſpirits ſhould haue any cauities to be laboured in; and hee ſheweth it by an example. When wee ſhut one eye the Animall ſpirit in a moment returneth vnto the other, ſo that it dilateth the ball or pupill of the other, and yet is there no manifeſt paſſage between them, ſauing thoſe inſenſible pores which are in euery nerue and alſo in the ſubſtance of the braine. And hereunto ſubſcribeth alſo *Platerus* on this manner: the common opinion ſaith he, is that the Animall ſpirit is generated and contayned in the *Plexus Choroides*, which I cannot approue as well be-

Bauhine.

Platerus.

cauſe

cauſe theſe veſſelles are ſo very ſmall, as alſo becauſe ſo many excrements of the braine fall through the ventricles. I thinke therefore that the Animall ſpirit is tyed to the ſubſtance of the braine, ſo that the braine is neuer without Animall ſpirites, neither can the Animall ſpirites ſubſiſt in any part without the ſubſtance of the braine: for what elſe is the inward ſubſtance of euery Nerue but a kinde of production of the braine compaſſed about with a production alſo of the membranes of the ſame.

And thus much ſhall be ſufficient to haue ſayed concerning the vſe of the Braine and the generation of the Animall ſpirit. Now wee proceede to the After-braine or the *Cerebellum*.

CHAP. XIIII. *Of the Cerebellum or After-braine.*

THat the whole Maſſe of the Braine is diuided into the Braine & After-braine we haue already ſhewed. The cauſe of this diuiſion *Varollius* taketh to be this. Whereas of thoſe things which are apprehended by the ſenſes there are two chiefe, differing much the one from the other yet both of them ſo immediately ſeruiceable to the vnderſtanding that they cannot be ſubſtituted one for the other; wherof one belongeth to the Sight the other to the Hearing; and becauſe there is required to the perfection of ſight the mediation of a moiſt and wateriſh body as we ſee in the eyes; therefore for their behoofe eſpecially and of the viſible Species which they admit, that part of the braine was made which is the ſofter and ſo great that it filleth almoſt the whole Scull; and this is called properly *Cerebrum* or the Braine. But becauſe thoſe Species which are apprehended by ſound, or reſounding; do require a kinde of drines in their Organ, as *Hippocrates* excellently acknowledgeth (for where there is only moyſture there is little or no reſonance at all): therefore vnder the braine in the backepart of the head there is ordained and ſcituated a leſſer and faſter portion which they call *Cerebellum* we the *After-braine* which as it is truely harder then the braine it ſelfe, ſo is it conſequently dryer. And this is *Galens* opinion in the *6.* chapter of his 8. booke *de vſu partium* where he ſaith; that therefore it is harder then the braine becauſe it produceth hard Nerues; albeit *Veſalius*, *Columbus* and *Archangelus* wil not admit any difference in their ſubſtances. Wherefore the Braine it ſelfe was eſpecially made for the behoofe of the eyes, & theyr obiects: the After-braine for the vſe of reſounding *ſpecies* or ſuch things as were to bee repreſented to the hearing. And becauſe the ſight is more excellent then the hearing, miniſtring vnto vs more difference of things, therefore it is ſeated aboue the braine.

The reaſon of the diuiſion of the Braine.

Galen.

Veſalius.

Why the braine is aboue the after braine.

The *Cerebellum* or After-braine, called in Greeke παρεγκέφαλις and by *Ariſtotle* ἐπικρανὶς, that is *after the Braine*; is as it were a priuate and ſmall Braine ſcituated in the backe and lower part of the ſcull vnder the Braine [Tab. 11. fig. 8. $^{R\,R}$] from which it is ſeparated: it is alſo couered with both the Meninges or Membranes, and is vnited to the ſpinal marrow for a little ſpace where alſo it affoordeth a part out of it ſelfe to make the bulke of the ſame narrow.

The after-braine. *Ariſtotle.*

His connection.

In brute Beaſts it is round and acuminated or growing ſharpe and taketh vp almoſt all the backpart of the head. It is continuated on eyther hand to the ſides of the Braine by two orbicular or round portions: [Table 11, fig. 8. neare $^{R\,O}$.] But to the ſpinall marrow it is ioyned in the very middeſt, yet toward the backſide, [Table 12, fig. 9. ^{R}] by the interpoſition of the *Pia mater*: And becauſe the fourth ventricle ſhould not there ſtart open it is compaſſed with the thinne Membrane which is ſpred as farre as to the Buttocks. [Table 11, fig. 8. betwixt $^{O\,P}$ and ^{Q}] It is ſeparated from the braine that through the thicke Membrane the veſſels might be ſecurely conueyed into the depth of the braine.

The forme of it is broader then long or deepe, and in the lower and backpart it reſembleth a flat bowle, in the middeſt whereof there is a ſharpe impreſsion ietting out from the bunch of the Nowle-bone; forward toward the buttocks of the braine it runs into a ſharpe wedge hauing that figure becauſe the place will admit no other.

The forme of the after-braine.

It conſiſteth of three parts, the right, the left, and the middle (which yet are not diuided but continuated) becauſe of the bunch of the Nowle-bone, of which we ſhall ſpeake more particularly heereafter.

The parts of it.

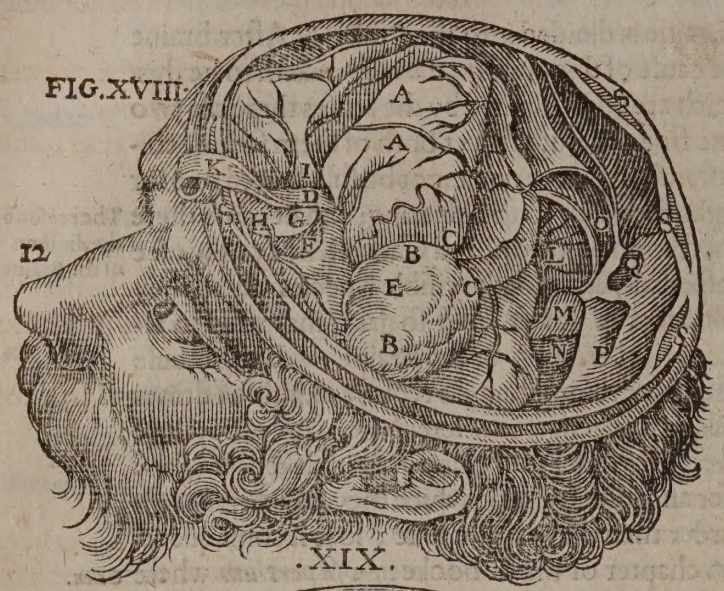
The right and the left parts are like two bowles ſet together, [Table. 12, fig. 9. $^{R\,D}$] in the middeſt of which where the bowels do not touch, is placed the third part which is rounde and runneth as it were into a Ring from before backward, & maketh thoſe proceſſes which are called *vermiculares*. By reaſon of theſe parts it hath three-fold impreſsions, ſome ouerthwart

Table 14. *figure* 18. *Sheweth the Head on the left side somwhat raised from the right side, as also a part of the Brain (the After-Braine being remooued) remaining, and a little eleuated and reflected backeward, that the Instruments of smelling might be discerned.*

Figure 19. *sheweth the Head set vpon the Nowle, that a portion of the Braine hanging backward, the Organs of smelling, the coition or meeting of the Optick Nerues and the Soporary Arteries might better appeare.*

TABVLA. XIIII.

FIG. XVIII.



.XIX.

AA, BB, the brain couerd with the *pia mater*.
CC. The swellings of the braine called by some Mamillary processes.
D, One of the organs of smelling remaining yet in his owne seate.
E. The other togither with the braine reflected backward.
F, the *sinus* of the left organ of smelling couered here with the thick *meninx* perforated
G, The partition of the organs of smelling.
H. The sixt veine of the braine deriued into rhe *dura meninx*.
I. The fift veine of the braine which goeth into the scull through the hole, ordained for the issuing out of the Nerues of the 5 coniugation.
K. A part of the Syth going to the partitiō
L M N. The place or seate of the *Cerebellum* or After-brain.
O P Q. The right, left and middle Sinus of the *Dura meninx*.
SSS. The double Tabulature of the scull.

Figure 19.

AA, BB. A portion of the braine couered with the *pia mater*.
CC. Those swellings of the brain which are called the Mamillary processes.
D, E. The organs of smelling reflected togither with the braine.
FFFF. The two vpper shew the bosomes of the scull in which the Mamillary processes do rest, the two lower shewe the bosoms or cauities of the organs of smelling
G. A partition distinguishing these organes and their bosomes or cauities.
H. the 6 veine doth here enter into the scull.
I. The fift veine of the braine.
K. A vessell like a veine running out of the *dura meninx* into the *Tenuis*.
LL. The beginning of those passages which run by the sides of the *dura meninx* ioynd to the arteries after the maner of Veines.
M N. The right and left optick nerues.
O. Their coition or coniunction.
P. A branch of the Soporary artery, perforating the Dura Meninx at the side of the Tunnell.
Q. A branch of the Arterie reaching to the right ventricle.
R. Another branch going to the *Pia mater*.
S. The Tunnel receyuing the Phlegm of the braine.

thwart and scored along through it; others running right downeward which are ioyned on eyther side as it were vnto a Center. For the lynes it hath are long and almost superficiary, yet diuided manifold and distinguished by the thin membrane running betwixt them. The reason why they runne in the superficies or surface only is, because if they did descend deeper as we see in the Conuolutions of the Braine it selfe, they would perforate the *Cerebellum* euen vnto the ventricle. They are also manifolde that their plenty might supply their superficiall course; as for those long and winding contortions which are in the braine, in this After-braine they are not to be found.

The Line.

Why superficiary.

The substance of it is almost the same with the substance of the Braine it selfe, if wee take it freed from the *Pia mater*, excepting in the Basis of the Braine where the spinall marrow beginneth, which is harder then all the other parts, yea then the After-braine it selfe.

The substance

For

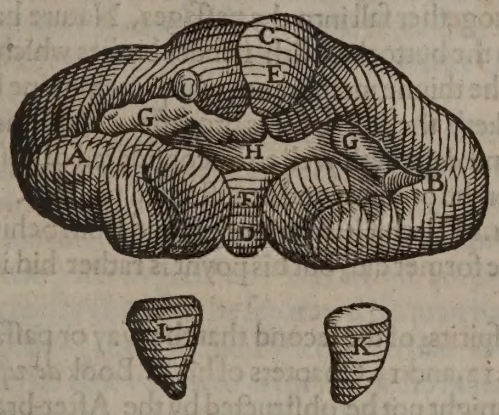
Table 15. Figure 20. ſheweth the head turned vppon the Eare, that the i ner Baſis of the Skull couered with the dura Meninx *might be ſeene, there is a ſo ſo much of the Braine and ſpinall marrow left, as ſerueth to exhibite the coniugations of the nernes of the Braine.*

Figure 21. ſheweth the After-braine taken out of the Skull, ſeparated from the ſpinall marrow, and lying with the lower ſide vpward: from which alſo the wormy proceſſes are ſeuered.

TABVLA. XV.

FIG XX.

XXI.



AA, a part of the marrow of the braine, together with the beginning of the ſpinall marrow.
BB, a portion of the opticke nerues.
CC, the Tunnel receiuing the phlegme
D, a hole out of the third ventricle into the Tunnell.
EF, branches of the *ſoporarie* arteries, attaining vnto the skul near the Tunnel.
G, the ſecond paire of nerues moouing the eies.
H, the third coniugation, or the greater roote of the third coniugation.
I, the third paire of nerues, after ſome the fourth.
K, the fourth paire of the braine.
L, the leſſer roote of the fift paire.
M, the fift paire of nerues of the braine.
N, the beginning and ſurcles of the ſixt paire of nerues.
O, the beginning of the ſeuenth paire of nerues.

Figure 21.

AB, the right and left part of the After-braine.
CD, the *anterior* and *poſterior* regions of the middle part of the After-braine.
E, the *anterior* wormy proceſſe.
F, the *poſterior* wormy proceſſe.
GG, In this place the After-braine did grow to the ſpinall marrow.
H, the cauity of the After-braine which with the cauity in the ſpinall marrow maketh the fourth ventricle.
IK, the *anterior* and *poſterior* proceſſes of the braine, called *vermi-formes* or the wormy proceſſes.

For this ſpinall marrow neither in colour nor in hardneſſe is anſwerable to the *Cerebellum*; becauſe the After-braine is yellower or rather more Aſh-coloured, being no where white but in the ſurface of his ventricle; but the ſpinall marrow is exceeding white, as alſo is the Baſis of the Braine which giueth beginning vnto it.

The quantity of the After-braine is much leſſe then that of the Braine. The Braine being as ſayth *Fallopius* foure times, as *Veſalius* would haue it, tenne times as bigge as the *Cerebellum*. The quantity.

In the middeſt thereof it hath a broad *Sinus* or hollowneſſe not very deepe, which maketh as it were the roofe or vpper ſide of the fourth ventricle, for the reſt of it is couered with the thin membrane; [Table 15. fig. 21. ⁿ] with in ward it hath no cauities as hath the braine, becauſe it neither aboundeth with ſo many excrements, and thoſe it doth gather, it eaſily turneth downe on the out ſide. The *Sinus*.

It hath two proceſſes (*Platerus* reckons foure) [Table 15. figu. 21. C D] which becauſe they are like to wormes in rotten wood, *Galen* in the 14. Chapter of his 8. Book *de vſu partium* calleth *vermi-formes excreſcentias*, VVormy proceſſes, one of which regardeth the foreſide, the other the back of that ventricle which is common to the After-braine and the ſpi- *Platerus*, *Galen*. The wormy proceſſes.

ſpinall marrow. Theſe proceſſes are diuerſly orbiculated or rowled vp, conſiſting of many particles, not oblique or right but tranſuerſe, coupled together by the *pia mater* or thin membrane, whoſe end or top is embowed and thinne (which *Aurantius* calleth the *peaſe*) and entreth the cauity which they call the Ciſterne, yea into the fourth ventricle.

Aurantius.

Archangelus. his opinion of the ſubſtance of the wormy proceſſe.

Archangelus maketh this wormy proceſſe not as *Galen* would haue it, to be of the ſubſtance of the braine and a part thereof, but a long membranous body, being indeede nothing elſe but the *pia mater* corrugated or foulded together, which in the dilatation of the braine is neceſſarily extended: but in the contraction is corrugated or crumpled vp like a worme.

For becauſe (ſayeth hee) the braines of thoſe that die are contracted and fall into themſelues, it neceſſarily followes that after death the membrane muſt in that part bee contracted.

It appeareth alſo thicker then otherwiſe the crumpled membrane would, becauſe being ſcituated in a low part, it receiueth the moyſture there collected and encreaſeth with that additament. VVherefore ſayth he the worme as it is a worme is of no vſe at all. But to returne.

The firſt proceſſe.

VVe ſayde theſe wormy proceſſes were two, the firſt which lyeth on the forepart [tab 15. figure 21. C] neare the buttocks is thought by *Galen* in the 5. Chapter of his 9. Booke of Anatomicall Adminiſtrations, to keepe open the paſſage of the third ventricle into the fourth; albeit *Veſalius* taxeth *Galen* for aſsigning that vſe vnto it. *Galen* alſo in the 14. chapter of his 8. Booke *de vſu partium* ſayth further, that this proceſſe when it is extended ouer the foreſaid paſſage doth wholly obſtruct or ſtop the ſame; but if it be reflected backward and rowled vp, his imbowed parts do draw the membrane to them adioyned, and the paſſage is ſo farre opened as way is made by that retraction. For as it is reflected and rowled round, by howe much the length of it is diminiſhed by ſo much the breadth is encreaſed; wherefore it behoued not, that theſe proceſſes ſhould be either too thicke or too thin: not too thicke, for then they could not haue exactly cloſed the paſſages becauſe they ſhould haue had no ſlender parts which might haue inſinuated themſelues into the narrow ſtraits of the paſſages. Againe, if they had beene too thin, the paſſages before ſaid could neither haue bin exactly ſhut nor well opened.

Galens vſe of the wormy proceſſes.

And leaſt theſe proceſſes ſhould altogether fall into the paſſages, Nature hath on eyther ſide bound and conioyned them to the buttockes with ſlender bodies which the Anatomiſts call *Tendines* proceeding from the thinne membrane; which membrane being extended to the hinde-moſt ventricle maketh the end of this proceſſe. And this is *Galens* Anatomy concerning theſe proceſſes, and deſerueth well to be conſidered of, eſpecially if we make our diſſection of the head after the ordinary and accuſtomed manner.

The 2 proceſſe.

The other proceſſe [table 15. fig. 21. FD] which is the hinder, and from behinde inclineth forward, doeth not beare out as the former did, but his poynt is rather hid in the ſubſtance of the *Sinus* of the After-braine.

Their vſe.

The vſe of the firſt is to vſher the ſpirits; of the ſecond that the way or paſſage of the fourth ventricle (which *Galen* in the 11. 12. and 13. Chapters of his 8. Book *de vſu partium* calleth the ventricle of the *Cerebellum*) might not be obſtructed by the After-braine preſſing vpon it. But we are of opinion that this is the common vſe of both the proceſſes, becauſe this paſſage (ſo often now mentioned out of the third into the fourth vẽtricle) ought neuer to be ſhut but to remaine alwayes open that the Animall ſpirit might haue perpetuall free influence into the ſpinall marrow. *Platerus* thinkes that this vſe is common to all the foure proceſſes (for he reckoneth foure.) But *Veſalius* aſsigneth to them no other motion or office then to the reſt of the ſubſtance of the *Cerebellum*, but if you aske his reaſon, I thinke it was onely that he might gain-ſay *Galen*.

At the ſides of theſe proceſſes we meet with two other portions which are continuated to the ſpinall marrow [table 15. fig. 21. GG.]

The vſe of the *Cerebellum.*

The vſe of the After-braine (as ſaith *Galen* in the 6. Chapter of his 8. Book *de vſu partium*) is that from it the harder nerues might haue their originall; which notwithſtanding *Veſalius* and *Columbus* doe deny. *Archangelus* and *Platerus* eſteeme it to be of the ſame nature with the braine and adorned with the ſame faculties. *Galen* thinketh that the Animall ſpirit being contained in the whole ſubſtance of the braine, not only in the ventricles thereof, is in great quantity treaſured vp in this After-braine, as being to be the original of all the ſinewes which were to bee diſtributed into the whole body: and that thoſe mid-

dle

dle diſtances which tye together the parts heereof, are the paths and wayes wherein the Animall ſpirits diſport themſelues.

Finally, *Varolius* conceiueth, (which we partly touched before) that the Braine was eſpecially made for the eyes and the viſible obiects. The After-braine for the eares and reſemblances of ſounds to be conueyed vnto them. *Varolius.*

CHAP. XV. *Of the ſpinall Marrow or pith of the Backe.*

THE name of Marrow is properly attributed to that ſubſtance which is ſimple and vniforme, moiſt, fat, white, without ſenſe contained in the Cauity of bones and hath his original from the bloud; which through the veines ſlideth by ſecret pores and paſſages into their hollowneſſe or ſpungy ſides. It becommeth white and as it were ſpermaticall by a mutation it receiueth from the bones, becauſe in them it is ſtored to be their proper nouriſhment and to refreſh them when they are heated and dryed by motion or other violent cauſes. What true marrow is.

But of this marrow we do not intreat at this time: the name is improperly giuen to the Braine alſo and the pith of the Backe: For the Braine it ſelfe is called μυελὸς ἐγκεφαλίτης *medulla cerebralis* the Marrow of the Braine, becauſe ſaith *Plato* the ſubſtance thereof is marrowye, although there be great difference betweene them, for that it will not melt and conſume as marrow doth, and beſide is inueſted or clothed with both Membranes the thicke and the thin *meninx*. Why the Braine is called marrow. *Plato.*

Moreouer to diſtinguiſh it from ordinary marrow, it is called by *Galen* ῥαχίτης *Spinalis*. By *Hippocrates* in his book *de Carnibus*, νωτιαῖος *Dorſalis*, by others *Ceruicalis* and *Lumbaris*, becauſe it deſcendeth through the Neck, the Backe and the Loynes, and filleth the whole ſpine or Ridge-bone. The names of the pith.

Now there is a double acceptation of the Spinall marrow, for in the larger ſignification it ſignifieth the whole marrow of the Brain lengthened out, one part wherof is yet contained in the Scull, [Tab. 17, fig. 1. from D to F] the other continuall with the former yſſueth at the great hole of the Nowle-bone and deſcendeth to the very end of the ridge. [Tab. 16. fig. 1. from A to H] A double acceptation of the ſpinall marrow.

But in a ſtrict & more proper acceptation it betokeneth that part of the marrow which without the Scull is contayned in all the racke-bones or *vertebræ* of the ſpine or chine. [Tab. 16. fig. 1. is an expreſſe Image of it] Wherefore that it may bee free from all ambiguity, the hiſtory thereof is on this manner.

That which is commonly called the Braine, that is, the whole ſubſtance included within the Scull we haue diuided into the Shell and the Kernell or Marrow. For theſe two differ in colour and conſiſtence. That which on euery ſide compaſſeth the marrow is Aſh-coloured; the marrow it ſelfe is white and of a more ſolid, faſt and compacted ſubſtance: and theſe two parts in greene or freſh heads are diſtinguiſhed by many oblique lines, ſo that with a rayſor they may be ſeparated if a man haue a ſteddy and cunning hand, yet not without breaking both the ſubſtances; ſo that *Archangelus* ſaid well, that the white was drowned in the Aſh-coloured as the chriſtalin humor of the eye is in the glaſſie; and as the glaſſie humor is eſteemed to be the Aliment of the chriſtaline, ſo the Aſh coloured ſubſtance may well be thought to be the foode of the white, becauſe the Aſh-coloured appeareth ſo to be by reaſon of innumerable veines diſſeminated through it. The parts of the Braine. *Archangelus.* An elegant Comparison.

The marrow it ſelfe may be ſaid to be double, one Globous or round, the other Long. The Globous part which is like the figure of the Scull, is of a great bulke and therein are ventricles excauated or hollowed. At this and continuall with it hangeth the other called *Cerebellum* of which we haue intreated in the Chapter going before according to the receiued opinion of Anatomiſts. The marrow double. Globous.

The Long marrow of the Braine which is like a Pith or ſtaffe may bee diuided into that part which is contained within the Scull, and that which is yſſued out which properly is called the ſpinall marrow; although ſome there are that giue this name vnto all the Long marrow of the Braine as well within the Scull as without; and this is it of which wee now ſpeake. Long.

The Spinall Marrow therefore according to this large ſignification taketh his beginning (as *Galen* ſaith in the tenth chapter of his 8. book *de vſu partium*) from the backe ventricle of the Braine; for he thought it nothing elſe but the Braine lengthened, which may ſeeme to agree with the Scripture which calleth it *The ſiluer cord*. And this, hee ſaith in the twelth The originall of the ſpinal marrow. Eccleſiaſtes.

twelfth chapter of the former book, is continuated onely with the Braine at the Basis thereof.

Diuers opinions. There be many opinions of the originall of this spinall marrow, we will reckon vnto you the most notable.

Hippocrates opinion. The first is that of *Hippocrates* in his booke *de Carnibus*, where he saith in general words that it ariseth from the Braine.

Galen. *Galen* more particularly and distinctly from the hinder ventricle of the Braine.

The common opinion. The common opinion is that it ariseth out of the *Cerebellum* or After-braine.

Vesalius. *Vesalius* saies from the Basis or foundation of the Braine.

Archangelus. *Archangelus* from the Globous part of the marrow of the Braine, betwixt the Braine it selfe and the *Cerebellum*;

Platerus. for those that say it hath a double beginning say as much as nothing. *Platerus* thinketh that it proceedeth like a new Long Braine from the Basis of the other and receiueth

Columbus. increase of strength from the *Cerebellum* also. *Columbus* saith it is nothing else but a Long Braine hauing a double beginning, the one greater from the braine it selfe, the other lesser from the after-braine. The beginning it hath from the braine is but single, that it hath from the after-braine is double and as it were forked into a right and a left. The greater originall is from the forepart of the braine but a little distant from the Region of the Opticke sinewes, and therefore, saith he, I am constrained to confesse that the 3, 4, 5, 6, 7, and 8. paires of sinewes do not arise from the braine but from the spinall marrow.

Varollius. *Varollius* who indeed was excellent in diseccting of the head saith, that there yssue from the braine and the *Cerebellum* foure roots making one notable trunke which they call the spinall marrow, out of which do yssue Nerues deriued vnto all the parts of the body.

Laurentius. *Laurentius* is also of the same opinion. The truth is, that it is a production as well of the braine it selfe as of the after-braine out of which it proceedeth as a stemme from the roote, which we shall more particularly shew afterward.

The scituatiō and proportion thereof. This spinall marrow lying vnder the *Cerebellum* to which it is continewed, taketh vp that hollownes of the Scull which is aboue the great perforation or hole in the bone of the Nowle or backpart of the head; and the beginning thereof for the length of foure fingers breadth cleaueth to the braine within the Scull, [Table 17, fig. 1. from ᴰ to ᴱ] the latitude and depth of that originall are so æquall that it appeareth almost circular neere the quantity and forme of an Hens Egge as *Archangelus* saith; and from this originall those Nerues which are accounted the proper sinewes of the braine together with the Organs of smelling are produced and deriued into the Instrument of the fiue senses as *Varollius*, *Plater*, *Archangelus*, *Laurentius*, and *Dominicus* do ioyntly agree.

The spinall Marrow properly so called. But the spinall marrow properly so called or the other part of it which is continuall with the former [Table 16, fig. 1.] is wholy without the Scull. For when the marrow of the braine now lengthened attaineth vnto the great perforation in the Nowle-bone [Tab. 13, fig. 17.ᴷ] it discendeth and passeth along through the holes of the racke-bones euen to the end of the *os sacrum* or holy bone. It passeth I say through the bones themselues,

Galen. least being soft and like the substance of the braine as *Galen speaketh*, it should in the length of his production suffer violence by those things which might light vpon it, whereas now

His course. the bones are as it were a safe conduct and firme defence thereunto all the way that it passeth.

And hence it is, that the *Græcians* call this perforated part of the spine, ἱερὰν συρίγγα *sacram fistulam* the holy pipe. Sacred or holy becaus it containeth a principall part, and a pipe becaus it is as it were fistulated or bored, through which Canity such a substance is transported as where from all the other Nerues are produced.

The 3. Membranes of the Marrow. It is inuested or clothed with three membranes which *Hippoc.* in his booke *de Arte* calleth ἔλυτρα. The first of which, according to *Galen*, arisieth from a strong ligament exactly fastening the foreparts of the *vertebræ* or rackebones, which ligament in the backpart determineth into a Neruous and strong coate, least in the bending or extention of the spine it

The first. should be broken or offended by the bones; becaus it is contained not as the braine in any immouable bone, but in rack-bones, which are not only moued but also sometimes somewhat dislocated. Wherefore the Nerues also which arise from the spinall marrow properly so called (least they should bee offended by the hardnes of the bones through which they passe) are clothed beside the two Menings with this third coate also.

The vse of the humor. About this is a thicke and slimy humor powred, as also about all the ioynts and parts that were to be moued; least being ouer dried they should suffer paine, and so their actions or functions be interrupted; which wisedome of Nature men doe imitate when about the

Axeltrees

Axle-trees of Carts and Coaches they ſmeare a ſoft and *viſcous* greaſe that they might more currantly moue.

The ſecond membrane ariſeth from the *dura mater* or hard Meninx; the third from the *pia mater* or thinne Meninx [Tab. 16. figure 1. expreſſeth the coates ioyned together] which two are not ſeparated as they bee in the braine: moreouer the thicker ſecureth the marrow from the bones, the thinner infoldeth his veſſels and cloſely bindeth together his ſoft ſubſtance, for through the thinne membrane the veines and arteries which nouriſh the marrow and ſupply it with vitall ſpirites are conuayed; which veſſelles we haue obſerued to proceede from the veines and arteries of the loynes as wee haue already ſhewed in the third Booke. The ſecond and third Membrane. The veſſels of the marrow.

The ſubſtance of this ſpinall marrow is all one with that of the Baſis of the braine, or rather of the globus marrow. VVherefore it is ſomewhat hard, compacted and white, yet ſo that it is much harder then the braine it ſelfe. And *Galen* in diuers places of his ninth Booke *de vſu partium* ſayth, that this ſpinall marrow is the originall of the harder nerues, as the forepart of the braine is of the ſofter: for to the ſtrength of motion a harder production was more behoofefull; and for the exactnes of ſence a ſofter. Note againe that the further it is diſtant from the braine, by ſo much it is harder and more compact; neither is it anſwerable to the colour and hardnes of the *Cerebellum*. For the *Cerebellum* or After-brain is onely white in the ſurface of his ventricle, other-where it is yellowiſh or Aſh-coloured; but the ſpinall marrow is very white moſt like to the marrow of the braine, ſauing that it is without any contortions or conuolutions, becauſe it is made onely to receiue and not further to labour that it hath receiued. His ſubſtance. *Galen.*

VVith the Braine it hath theſe things common; firſt his ſubſtance; ſecondly that it is an originall of ſinewes (*Ga.* addeth of all ſinewes) and is compaſſed with both the Meninges. Yet heerein they ſay it doeth not communicate with it, becauſe the braine (though it bee contayned within an immouable bone) yet beateth and is moued; wheras this marrow albeit be contayned within mouable ſpondels or rack-bones is not it ſelfe at all moued. But if that motion bee in the ſubſtance of the braine by an in-bred faculty, and the ſpinall marrow hath the ſame nature and ſubſtance that the braine hath, me thinks it ſhould bee reaſonable that this marrow ſhould be moued in like manner as the braine is moued, albeit our ſence is not apprehenſiue of it. And truely *Archangelus* conceiueth that it hath a motion, and when it is dilated receiueth Animall ſpirits from the fourth ventricle, and when it is contracted powreth them againe forth into the nerues which ariſe there-from. What it hath common with the Braine.

The figure of it is long, thicke and large at the originall, [Table 17. figure 1. from D to E tab. 16. fig. 2. from A to B] and though being gathered together it become ſomewhat narrower, yet is it not (as ſome thinke) by little and little continually attenuated till it come to the extremity of the *os ſacrum*: for as far as the *vertebræ* of the loynes [table 16. fig. 1. from I to K] it keepeth an equall thickneſſe almoſt; although *Galen* and *Veſalius* did thinke that it was conſumed as it ſent more nerues out from it. *Fallopius* in his obſeruations and *Platerus* doe not thinke that it groweth leſſe at all. Yet we muſt needes acknowledge that we find it fuller & thicker in the neck whence thoſe great nerues iſſue which are diſperſed through the armes, [Table 16. fig. 1. from I to K] and in the loynes whence proceede the great nerues of the loynes which deſcend vnto the thighes; [tab. 16. fig. 1. from B to C] and that afterward when it commeth nearer to the *os ſacrum* his marrowy ſubſtance is ſomewhat abated. The figure.

A cauity or *Sinus* there is formed in it preſently after his originall whileſt it yet remaineth within the Skull; which is like a writing pen, and therefore it is called *Calamus ſcriptorius* [Table 12. fig. 10. KLNO] for it is hollowed into a poynt or neb becomming leſſe by degrees, becauſe in that place there are no more excrements. His cauity. *Calamus ſcriptorius.*

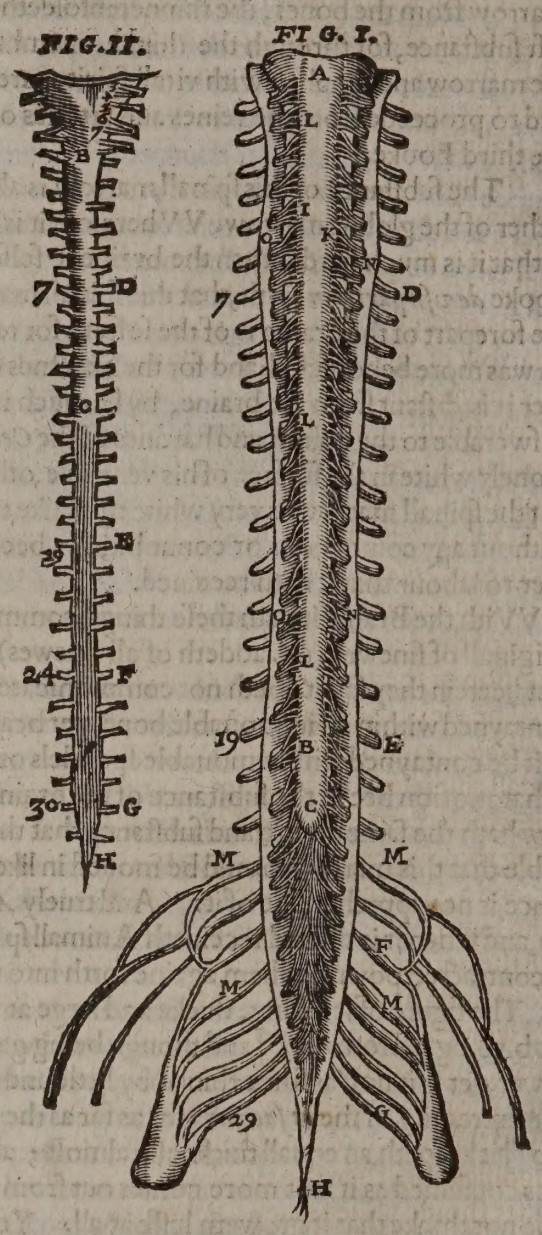
This cauity maketh the middle part of the fourth ventricle of the braine; for the reſt of the ventricle is formed by the After-braine [table 15. figure 21. H] at which place the After-braine is ioyned to this marrow. [Table 15. fig. 21. GG is ioyned to B C as alſo in the 12. tab. and fig. 10.] *Archangelus* conceiueth that this cauity is vnder the fourth ventricle and continued with it, and that out of the fourth ventricle into it the Animall ſpirits doe flow, and that from this cauity they are diſtributed moſt what into all the fiue ſences. *Archangelus.*

And although the marrow be but ſingle and ſeemeth to haue no manifeſt cauity, yet in the very middeſt it is deuided into two parts by the thinne Meninx as far as to the rack-bones of the loynes; ſo that on either ſide there appeareth a little cauity which may not onely be demonſtrated in the marrow of an Oxe if it bee lightly boyled, but alſo as ſayeth

Table 16. Figure 1. sheweth the true forme of the spinall marrow properly so called, together with his membranes & the nerues proceeding from the same.

Figure 2. sheweth the spinal marrow naked & bare, as it appeareth both within the skull & without; together with his nerues as most part of the Anatomistes heretofore haue described it.

TABVLA. XVI



A, The beginning of the spinall marrowe where it fals out of the skull.

B, the thickneſſe thereof in the ſpondels or rack-bones of the loynes.

C, the diuiſion thereof into ſtrings, or hairy threds.

D, the ſeauen nerues of the necke.

From D to *E* or from 7, to 19, ſhewe the nerues of the backe.

From *E* to F, the nerues of the loynes,

From F to G, the nerues of the *os ſacrum*, or holy bone.

H, the end of the marrow.

I K L, doe ſhew howe the nerues doe yſſue from the marrow in ſtrings.

MM, the knots of the ſinewes made of the coniunction of thoſe ſtrings.

NO, the membranes that inueſt the marrow.

Figure 2.

A, the beginning of the ſpinall marrow in the skull.

3,4,5,6,7. Theſe Characters ſhew (according to *Veſalius* opinion) how the cõiugations of the nerues of the braine doe take their originall from the marrow remayning yet within the skull.

B, the egreſſe of the ſpinall marrow out of the skull.

C, the cords or ſtrings whereinto it is diuided.

D 7, the marrow of the neck and ſeuen paire of ſinewes.

E 19 twelue pairs or coniugations of nerues proceeding from the marrowe of the Cheſt.

F 24, the marrow of the loynes and 5. paire of ſinewes.

G 30, the marrow of the holy-bone and 6, paire of ſinewes.

H, the extremity or end of the ſpinall marrow.

Platerus in a mans, becauſe it may bee parted aſunder without laceration. *Archangelus* thinks this cauity to be ſufficiently manifeſt to the eye; we are ſure to the vnderſtanding it is moſt apparant, by that we finde in thoſe that are troubled with the Palſie, in whome ſometimes one ſide ſometimes another is alone affected. Howſoeuer the marrow appearing ſimple and vndeuided paſſeth through the whole necke and the Cheſt euen vnto the loines and lower; [Tab. 16. fig. 1. from A to B] and in his paſſage it ſcattereth nerues out of his ſides: afterward, that is, at the reſt of the loynes it is no more ſimple but deuided into many ſmal threds and filaments, very much reſembling a horſe tayle and ſo runneth on to the end of the *os ſacrum*. For as it began with the ſpine (wee meane the marrow properly ſo called) ſo it determineth therewith, ſometimes ſimple ſometimes deuided into three ſhort furcles. For it was neceſſary that in that part where the ſpine was eſpecially curued or bent backward or forward, it ſhould be diuerſly diuided that it might not be compreſſed by the *vertebræ*. Hence the reaſon appeareth why a hurt or annoyance in the lower part of the ſpinall marrow is worſe and more dangerous then in the vpper, becauſe below it is more Neruous aboue more marrowy.

How it may be ſaide to be deuided and where.

Now although the Nerues yſſuing from the ſpinall marrow be almoſt infinite, yet according to the number of the out-lets or holes of the *vertebræ* they are ſaid to be ſo many coniugations as the *vertebræ* haue holes. For euery Nerue doth indeed conſiſt of many hairy ſtrings or marrowy fibres, which by the helpe of the Membranes at the holes of the

Whereof his nerues are made & how they yſſue.

ver-

vertebræ are conioyned and making as it were a knot do yſſue out of the bone; ſo that one Nerue ſeemeth to be made of one propagation, [Table 16. the firſt figure ſheweth it at LL] which thing as it is true in thoſe Nerues which proceede out of the Marrow whileſt it is ſimple and ſingle, ſo is it alſo in them which after the diuiſion are diſtributed into the lower parts. [Table 16, fig. 1, at MM]

To put an end to our diſcription of the ſpinall marrow, we will take leaue to inſert in this placea deſcription therof out of *Rondeletius* and *Laurentius* which is on this manner *Rondeletius.* All the Nerues, (ſaith *Rondeletius*) which no man before me hath obſerued, are diuided frō the very beginning of the ſpinall marrow in the Brain. Wherfore the cauſe of the Paralyſis or Palſie doth not ſo much proceed from the marrow of the backe as from the very heads of the ſinewes; & thence it is that *Galen* ſo often repeateth that the Palſie hapneth when the heads of the ſinewes are eyther obſtructed or reſolued. Thus *Rondeletius* hath it in his chap. of the Palſie. *Laurentius* thus: All Anatomies haue hitherto beene ignorant of the originall and propagation of the Nerues of the ſpinall marrow; for they al thinke that the nerues of the necke come onely from the marrow of the necke; the nerues of the backe from the marrow of the backe, and of the Loynes from the marrow of the Loynes. But how miſerably they haue bin miſtakē, is conuinced by a new and vnheard of obſeruation of mine own. Separate therefore the marrow from the rack-bones but keepe it whole, then take from it both the Membranes wherewith it is compaſſed, caſt it into water and ſhake it a little, and you ſhall perceiue that the whole marrow from the top to the bottome is made of innumerable ſurcles and filaments, like a Horſe tayle compoſed of infinite hayres; and that the nerues of *os ſacrum* do ariſe from the ſame beginning with the nerues that are abōue. This new and admirable obſeruation maketh plaine an obſcure probleme, why, when the marrow of the neck is offended the motion of the thigh is ſometimes taken away, when as the motion of the armes and of the Cheſt is not at al vitiated; thus far *Laurentius*. To conclude. *Laurentius.* A hard probleme explained.

The vſe of the ſpinall marrow properly ſo called, is ſaith *Galen* in his twelfth booke *de vſu partium*, that from it as from one other brain there ſhould proceed many nerues as it were ſmall riuerets which might conuey the Animall faculty, ſenſe, motion and the Animall ſpirit; which they receiue by continuation from the braine (to the parts vnder the head) excepting thoſe whereto are tranſmitted certaine propagations from the ſixt payre [table 17. fig. 1, and 2, C] of the marrow of the braine, which alſo are diſſeminated through the middle and lower bellies. For, becauſe it was not ſafe, in conſideration of the length of the way, that all the nerues ſhould be tranſported vnto the inferior parts from the marrow of the braine contained in the Scull; and yet it was neceſſary that thoſe inferior parts ſhould be ſupplyed with voluntary motion and ſenſe to apprehend annoyances: it was moſt requiſite that from this marrow, as from the braine elongated or produced, thoſe ſinewes ſhould be deriued; for if a man had wanted motion hee had beene more like an Image then a creature. And thus much of the vſe of the marrow properly ſo called. But if you take it in the larger ſignification, then the vſe of it is, that from it where it is included within the Scull on both ſides ſhould yſſue ſeauen Coniugations or payres of nerues, (as is commonly thought) we ſay eight, which are called the nerues of the braine, [table 15, fig. 20, BGHIKMNO] together with the Organs of ſmelling. [table 14, fig. 19, DE] But as it conſiſteth in the ſpine without the Scul there are produced there-from thirty paire [table 16, fig. 1] euen al the nerues that paſſe through the whole body. And thus much of both the braines and the ſpinall marrow, now it followeth that we ſhould intreat of the nerues yſſuing there-from. The vſe of the ſpinal marow

CHAP. XVI. *Of the Nerues of the Braine, and firſt of the Organs of ſmelling, called Proceſſus Mammillares.*

THE Nature of the Braine, the After-braine & the Spinall Marrow being thus manifeſted, it remaineth that we ſhould ſpeake of the Nerues proceeding frō each of them; and firſt of the Nerues of the braine. Whereas therefore there are fiue outward ſenſes, the Sight, the Smell, the Hearing, the Taſte and the Touching, which from the braine it ſelfe or rather from the Marrowe thereof doe receiue by nerues as it were by Channels ſome of them the faculty of Senſation alone, ſome of them of Senſation and motion together, which nerues are ſayed thence to ariſe as from a principle of diſpenſation & radication, from whence they bring the Senſatiue and mouing faculties of the Soule to the inſtruments of the Sences: it is very fit that in this place we ſhould deliuer their hiſtory. Wee will therefore begin with the Organs of ſmelling. Although the Noſe be the way & path of ſmels, yet is not the inſtrument of ſmel- The 5. ſenſes: and their nerues.

ling, neither yet his hindmoſt coate; but farther within the skull there are certaine proceſſes or productions eſteemed for the very organs of this ſence, which the Anatomiſts looking onely vpon their prominent part haue called *Proceſſus mammillares*, and ſome the organs of ſmelling. Vnder which Title *Galen* hath written of them at large. Theſe are two ſome thing like nerues but ſcituated in the Baſis of the braine; they are whiter, ſofter and broader then nerues are. Notwithſtanding like nerues they are round and ſlender. In men they are very ſmall; in beaſtes as Oxen, Goates, Sheepe and Dogges they are much larger; whence it is that all theſe Creatures haue this ſence of Smelling more exquiſite then men.

Why beaſts ſmell better then men. Their originall.

Theſe proceſſes ariſing out of the marrowey ſubſtance of the braine in his Baſis [tab. 17

Tab. 17. *Fig.* 1. *Sheweth the Baſis of the Braine and After-braine freed from their membrane that the originall of the Nerues of the brain might be better perceiued.*

Fig. 2. *Sheweth one ſide of the Braine the After-brain, the ſpinall marrow and the Nerues.*

TABVLA. XVII.

FIG. I.

FIG. II.

A A 1,2. The braine.
B B 1,2, The After-braine.
C C, 1,2, the ſwellings of the braine which ſome call the mammillary proceſſes.
D, 1, the beginning of the ſpinal marow out of the Baſis of the braine.
E 1,2, a part of the ſpinall marrowe when it is ready to yſſue out of the skull.
F F, 1,2, the mammillary proceſſes which ſerue for the ſence of Smelling.
G G 1,2, the opticke nerues.
H 1, the coition or vnion of the optick nerues.
I I 1,2, the coate of the eye whereinto the optick nerue is extended.
K K 1,2, the ſecond paire of ſinewes ordained for the motion of the eyes.
L L 1,2, the third paire of ſinewes, or according to moſt Anatomiſts the leſſer roote of the third paire.
M M 1,2 the fourth paire of ſinewes, or the greater roote of the third paire.
N 2, a braunch of the third coniugation deriued to the muſculous skin of the forehead.
O 2, a branch of the ſame to the vpper iaw.
P P 2, another into the coate of the noſethrils.
Q 2, another into the temporall muſcle.
R 2, a branch of the fourth coniugation crumpled like the tendrill of a vine.
S 2, a branch of the ſame reaching vnto the vpper teeth and the gummes.
T 2, another of the ſame to the lower iaw.
V 2, a Surcle of the branch, T to the lower lip.
X X 2, other ſurcles from the braunch T to the rootes of the lower Teeth.
Y Y 2, the aſſumption of the nerue of the fourth coniugation vnto the coat of the toung.
Z 1,2, the fourth paire vulgarly ſo called which are ſpēt into the coate of the pallat.
a 1,2, the fift paire of ſinewes which belong to the hearing.
o, the *Auditory* nerue ſpred abroade into the cauity of the ſtony bone.
* a hard part of the fift coniugation aboue the * which may accounted for a diſtinct nerue.
b 1,2, a ſmall braunch deriued from this harder part of the fift payre.
c 1,2, a lower branch from the ſame originall.
d 1,2, this nerue is commonly aſcribed to the fift payre, but indeede is a diſtinct coniugation which we will call the Eight, becauſe wee would not interrupt the order of other mens accounts.
e 1.2, the ſixt paire of ſinewes. *f* 2, a branch from them deriued to the necke and the muſcles couched there upon, *g* 2, another branch to the muſcles of the larynx or throttle. *h* 1,2, the ſeauenth paire of ſinewes. *i* 1, the vnion of the ſeauenth paire with the ſixt. *l* 2, a propagation of the ſeauenth paire to thoſe muſcles which ariſe from the appendix called *Styloides*. *m* 2, Surcles from the ſeauenth coniugation to the muſcles of the toung, the bone *Hyois* and the Larynx. *o p q* 1, three holes; through the hole *o* the phlegme yſſueth out of the third ventricle of the braine to the Tunnell, and at *p q* is the paſſage of the *ſoporary* arteries to the ventricles of the braine.

fig.

fig.1.& 2.[F] tab.14.fig.19.[DE]],neare the optick nerues[tab.17.fig.1,2.[C]]do passe betwixt the braine,(whereto they are tyed by the mediation of the *pia mater*) the wedge-bone and the bone of the forehead vnto the *Sinus* or cauity of the spongy bone;[tab 14.fig.19.[H F]]which cauities are couered with the *dura meninx* diuersly perforated & are made to receiue these productions. To each of these processes saith *Fallopius* reacheth a manifest hole from the ventricle, from which hole the passage is open to the spongy bone. This passage in a man is very narrow,so that it cannot be discerned,but when the head is very greene or new. In Oxen it is very large.Through these passages & productions aire and vapors attracted or drawn in respiration through the nosthrils as it were by pipes and channels,are carried vn to the braine that it might iudge of odoriferous obiects. *Varolius* is of opinion that from these productions there is no free passage vnto the ventricles themselues;although *Fallopius* was vtterly of another minde. They are like to nerues in their passage, colour and vse, and therfore do well deserue to be called the *Nerues of smelling* as *Archangelus* stileth them. But *Vesalius* counteth them to be the first paire or coniugation of the braine; yet because they neuer attaine through the thicke membrane and cauity of the skul, neither hane as other nerues any propagations deriued from them: therefore neither *Herophilus* nor *Marinus* nor *Galen* himselfe, nor many amongst the *Neotericks* or new writers haue vouchsafed them the name of nerues;wee stand not vpon wordes and therefore passe from them vnto the nerues of the eies.

Fallopius.

Their vse.

How they may be called nerues.

CHAP. XVII. *Of the nerues of the Eyes, or of the first and second Coniugations.*

Albeit in a particular discourse hereafter following wee intend more districtly and carefully to prosecute the Nature and diuarications of nerues in generall and euery one in particular; yet because all the nerues of the head haue their originall from diuers partes of the substance of the same: Wee cannot chuse in this place but make some mention of them though it be the briefer.

The optick nerues.

The first coniugation therefore of the nerues of the braine are the Opticks,[Table 17. figure 1.and 2.[C]] larger and softer then all other simple nerues. Larger because they bee sensibly perforated,softer because they arise out of the Center of the Basis,whence proceeding forward with a slow course they are vnited aboue the saddle of the wedge-bone [tab. 17.figure 1.[B] table 14. figure 19.[C]]and so make a common body. After being againe separated [Table 14.figure 19.[M N] Table 17.figure 1. aboue [B]] they passe obliquely foreward through their proper hole] table 4.figure 10.[B]] the one to the Center of the right eye, the other to the Center of the left [ta.3.lib.8.fig.8.[a] or together with the membrane fig.2.[abc].]

Their double substance.

They consist of a double substance, the one marrowey the other membranous. The marrowey is soft like the substance of the braine,which you shall perceiue to yssue if it bee hard pressed,and of this marrowy substance dilated in the orbe of the eye is that coat made which of the similitude of a net is called *Retina tunica*[Tab.17.fig.1 and 2.I]and this compasseth the glassy humour like a sphere.

Marrowey.

Their membranes.

It hath two membranes from the two Meninges of the braine.The thin membrane inuesteth it from the originall to his out-let from the skul;the thick Meninx is added to it,frō thence to the eye;and so the thicke membrane degenerateth into the horny coate, the thin is consumed or spent in the *Vuea*,and so the Animall spirit is transported through the continuation of this nerue vnto the *pupilla* or Apple,which is the hole of the grapie mēbrane.

They are called therefore Opticke nerues from their action, because they communicate to the eye the sence of seeing.

The 2. coniugations of the mouing nerues.

The second coniugation is of the nerues which moue the eyes,[table 18.figure 1.and 2.[K] tab. 15.figure 20.[C]] which is distinguished from the former only by a little and thin bone, and riseth from the Basis of the braine [tab.25.fig.1.[c]] a little behinde the former as *Vesalius* saith. This is smaller and slenderer by much then is the opticke,as also harder because it was to be inserted into the muscles. It yssueth by a proper hole of his owne [tab.4.fig.10.[c]] which is the second of the wedge-bone, where after it is diuided into notable braunches which are sent into the muscles. In some bodies (though it be but seldom) they send small twigs to the temporall muscles; whence it is that sometimes if that muscle be offended the eie also suffereth with it, and so on the contrary.

Their frame.

Note this.

Their vse.

Why both eies moue together.

Their vse is to afford to the muscles the facultie of Motion, as also a drawing power to their membranes. Now the reason why when one eie is mooued to the side the other also necessarily followeth,is,because these nerues are continued one with another in their originall.

CHAP. XVIII. *Of the third and fourth coniugations of the Nerues of the Braine.*

The 3. Coniugation.

THE third coniugation [Tab. 19, fig.1 and 2 [L]. Ta. 15, fig.20 [B]] is sent vnto the Muscles of the face & is commonly called the smaller *roote* of the third paire, but it deserueth, we think, to be a particular coniugation, because it is not ioyned with the following paire [Tab.15. fig.20 [I]. Tab 19. fig.1 and 2. [L] with [M]] neyther in his beginning nor in his progresse.

His Original.

It ariseth from the lower and backer part of the marrow of the Braine. It is very smal and perforateth the *dura Meninx* at the side of the basis of the Braine where it is fastned to the second coniugation [Tab.19, fig.1. [K]] and so with it yssueth into the orbe of the eye by a hole common to them both. [Tab.3.fig.8, [C]] Then it is diuided into four branches: the first [Tab.19.fig.2 [N]] ascendeth vpwarde by the fat of the eye and yssueth at a hole of the forehead bone proper vnto it [Tab.3.fig.8 [A]] and so passeth into the skinne of the Forehead to which it giueth motion, as also to the vpper eye-brow.

Issue. 4. Branches.

The second descendeth [Tab.19. fig.2.O] and passeth through a hole of his owne, bored in the fourth bone of the vpper Iaw [Table.3. fig. 8. [B]] and so is dispersed into the Muscles of the vpper lip, into those that mooue the wing of the Nose outward, into the tip it selfe and some of the gummes.

The third branch [Tabl. 19.fig.2. [P]] passeth thorough the second hole of the vpper iaw [Tab.3.fig.8 C] and attaineth into the Cauity of the Nosethrilles and is spent into their coate, [Tab.19. figu.2. the lower P] and affoordeth a small surcle to the membranous Muscle vvhich contracteth the wing of the nose.

The fourth branch [Table.19.fig.2. [Q]] being led thorough the Fissure which is betwixt the bone of the vpper iawe and the Wedge-bone [Tab.3.fig.8 [D]] is spent into the inner part of the temporall muscles.

TABVLA. XIX.

FIG.I.

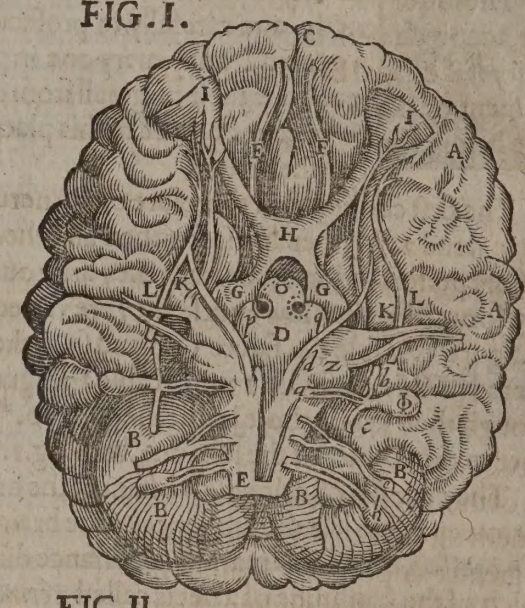
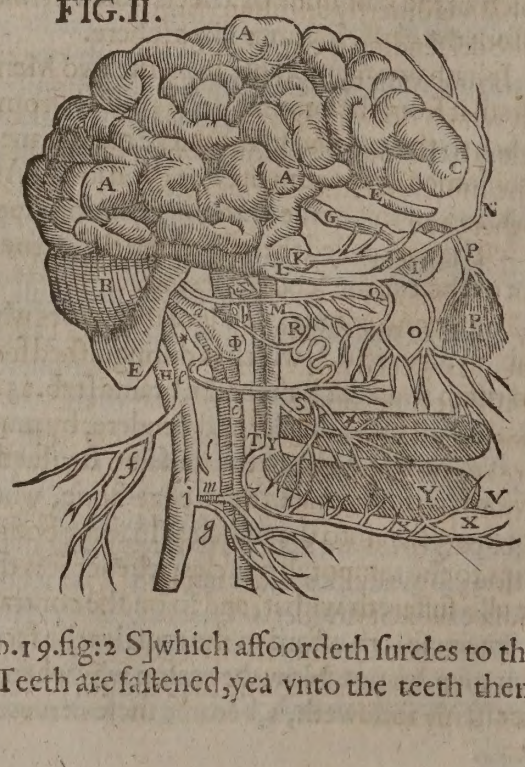


FIG.II.



The fourth Coniugation.

The Fourth Coniugation are the Nerues of Tasting, [Tab.19.fig.1. and 2. [M]. Tab.15.fig.20.I] it beareth on the former in his progresse but not in his originall. It proceedeth not out of the backe parts of the brain becouse they are hard; not out of the sides becouse their waye would not haue been safe; but out of the basis yea the very Marrow of the Braine [Tab.25.fig.1.Char.3] aswell for security as becouse of the Situation of the toong.

The reason of his Originall.

Where it yssueth.

It yssueth at the sixt hole of the wedg-bone [Tab.3.fig.9. [Q]] and presently sendeth a Surcle out of it like the crumpled Tendrill of a Vine, in which the Animall spirit maketh some stay. Afterwards, it is by two branches vnited to the Nerue of Hearing, [Table.19.fig.1,2. [b c]] and so is dissеminated into the muscles of the face the Temporall, the grinding Muscles of the Cheekes and to the Skinne of the face.

It hath three branches.

A second branch it also parteth with [Tab.19.fig:2 S] which affoordeth surcles to that part of the Gummes wherein the grinding Teeth are fastened, yea vnto the teeth themselues.

A third branch also sprowteth out of his back-part, [Table 19, fig.2.[t]] which is inserted into the muscle that lurketh within the mouth, and passeth through the inner hole [tab.11. lib.8.fig.2.[r]] of the lower law; and there offereth surcles to the Rootes of the lower teeth on the same side, [Tab.19, fig.2.[xx]] and by their helpe the teeth haue sense, whereas the other bones haue none. How the teeth haue sense.

Finally, the Trunke it selfe [Table 19, fig.2.[y]] passing through the muscles lurking in the mouth together with the Trunke of the other side attaine to the side of the tongue and is consumed into his coate to make it a conuenient Organ of Gustation.

CHAP. XIX. *Of the Nerue of hearing, or of the fift Coniugation of the Braine.*

THE fift Coniugation [Tab.20,fig.1,and 2,[a] Tab. 15, fig.20.[M]] ariseth out of the Marrow of the Braine lengthened, where it ioyneth with the *Cerebellum*. [Table 25,figure 1,[i]] There his originall seemeth to be out of two Surcles or Nerues, the one softer the other harder, which together perforate the membrane and passe to the stony bone. The fift Coniugation. His 2. surcles.

This Nerue passeth through a notable writhen hole thrilled in the stony-bone, which they call the fift hole of the Temple bone, where it meeteth with that cauity which is compared to a Conniborough and prepared for the Organ of hearing. Afterward the harder part falleth into the cauity called *Tympanum* or the Drum. His out-gate.

The softer part [Table 20,fig.2,[a]] which is indeed *Neruus auditorus* the sinew of hearing, accompanieth the former, and when it attaineth to the extremity of the aboue named cauity it is dilated like a membrane [Table 20,fig.1,2.Φ] and becommeth the speciall Instrument of hearing, and in that place remaineth haply after the same manner that wee saide before the Organ of Smelling was extended. The true Organ of hearing.

CHAP. XX. *Of the sixt, seauenth, and eight Coniugations of the Sinewes.*

THE sixt Coniugation [Tab.21,fig.1,and 2,[c] Tab.15,fig.20.[N]] taketh his beginning of a few fibres a little below the originall of the Nerue of *hearing*.

These Nerues being instantly vnited doe make one notable Nerue as some haue thought, but indeed they are neuer so vnited but that they remaine two Nerues contained or held together in one membrane, and passe out at one hole, [Tab.4,fig.10.[b]] which is counted the 2. hole of the *occipitium* or Nowle-bone. The one of those is the forwarder & the lesser: the other the backwarder & the greter. The lesser runneth directly to the muscles of the tongue, and for the most part is spent in the mouth; the greater as soone as it is issued out of the Scul sendeth a branch backward [Tab.21,fig.2,[f]] which is diuersly distributed into the *Mũcks-hood* muscle of the shoulder blade. The trũk it selfe descending is tyed to the seauenth Coniugation, [Tab.21,fig.2.[n]] and at the sides of the throtle is increased with a branch from that seauenth Coniugation, [Table. 21,fig.2,[i]] with which notwithstanding it is not mingled but onely colligated or tyed: after it sendeth surcles to the muscles of the *Layrinx* or throtle, [Tab.21,fig.2.[g]] as also some other smaller to the muscles of the Chops, thence it descendeth to the Chest, where we will leaue it til another time. That the sixt Coniugation is not one but two Nerues. Where it issueth. The course of it.

The seauenth Coniugation [Ta.21,fig.1,[h] fig.2,[n]] moues the tongue, and is the hardest of all the sinewes proceeding out of the Scull; for it ariseth iust at the place where the marrow of the braine falleth out of the Scul. [Tab.21,fig.1,2,[e]] It ariseth of many Roots somewhat distant each from other, which ioyning together into one do passe out of the Scull at an oblique hole bored in the bone of the *Occipitium*, and for more security is ioyned by strong membranes with the sixt Coniugation, yet not mingled therewith. For this seauenth paire keepeth his owne body and so runneth downward to the roote of the tongue, where the most part of it [Ta.21,fig. 2,[z]] is loosened into many fibres which giue motion therto. Other parts of it are deriued to the muscles of the bone *Hyois* and the Throtle to giue them motion; some surcles also it sendeth [Ta.21,fig.2,[l]] to those muscles that arise from the appendix called Stylo-ides. The seauenth Coniugation. His originall and course.

The eight Coniugation [Tab.21,fig.1,2,[d] Table.15, fig.20,[r]] proceedeth out of the marrow of the braine aboue the Auditory Nerue betwixt the second and the third Coniugations. The eight Coniugation.

It

It perforateth betwixt thoſe 2. paires the thicke Meninx and attayneth into the orbe of the eye through the hole that belongeth to the ſecond coniugation, and is almoſt wholly ſpent into that muſcle of the eye which draweth it vnto the vtter corner.

CHAP. XXI. *Of the Nerues proceeding from the ſpinal marrow properly ſo called.*

HAuing acquainted you with thoſe coniugations of ſinewes which belong vnto any part of the brain or his productions contained within the Skull, it remayneth nowe to giue you a ſhort viewe of thoſe nerues which are deriued out of the ſpinall marrow contayned in the rack-bones of the Chine. Theſe therefore are accounted to be 30. paire, all proceeding out of diſtinct and ſeueral parts; that is to ſay out of the racks of the neck, the cheſt, the loines & the holy-bone.

Seauen or 8. paires of the Necke.

The Coniugations of the Neck ſome account ſeauen, others eight, diſperſed into the outſide of the whole head and the muſcles thereof.

The firſt Coniugation yſſueth betweene the *Occipitium* or Nowle bone & the firſt rack-bone, and is diuided into two little branches, a forward and leſſer, [Tab.22,[H]] and a backward. [Tab.23,[F]]

The ſecond Coniugation of the Necke hath two originals, a forward [Tab.22,[N]] and a backward which is the larger, [Table 23,[I]] which is diuided into two branches, a thicker [Tab.23,[K]] and a thinner. [Tab.23,aboue [E]]

The 3. paire [Ta.22,charracter[3]] breaketh out of the common hole betweene the ſecond and the third ſpondels or rackes and is diuided into two branches, one forward [Tab.22.[P]] which is ſubdiuided into foure Surcles. The firſt at Tab. 22,[Q].] The ſecond at Ta. 22, and 23,[R].] The third at Tabble 22,[S] and Table 23,[X L].] The fourth at Tab.22, and 23,[T].] Another backward, [Tab.22, and 23,[O]] diſſeminated into the muſcles which are common to the head and the necke.

The fourth Coniugation [Tab.21, Char.[4]] falleth out of the common hole of the third and fourth *vertebræ*, and is diuided into two branches, the firſt forward and greater, [Tab. 22, and 23,[X]] which is diuided into three Surcles, the firſt at [tab.22,[y].] the ſecond at [tab. 22,[z].] the third at tab.22,[b].] The ſecond branch is the leſſer and more backward, [tab.22, and 23,[V]] and is ſpent in the muſcles of the Necke and the membranous muſcles of the Cheekes.

The fift Coniugation [tab.22, char.[5]] falleth out vnder the fourth rack-bone, and is diuided into two branches, one forward and another backward; the forward [tab.22, & 23,[d]] hath three Surcles, the firſt at tab.22,[a d]] the ſecond [tab.22,[c]] the third [table 22, & 23,[f]] The backward branch [tab.23,[c]] is diſtributed as is the backward branch of the fourth paire.

The ſixt Coniugation [table 22, char.[6]] falleth out vnder the firſt racke, and is likewiſe diuided into a fore and a hinder branch; the fore branch at [table 22,[l]] the hinder branch at [table 23,[k].]

The ſeauenth Coniugation [table 22, char.[7]] yſſueth vnder the ſixt racke bone of the Necke, and is ioyned with the ſixt paire of the Necke and the firſt of the Cheſt [tab.22,[r].] for more ſecurity; and the greateſt part of it paſſeth into the arme, which ſometime ſendeth a branch to accompliſh the Nerue of the Midriffe. The backer branch [table 23,[c]] is the leſſe, and is beſtowed vpon the muſcles lying vpon the necke and vpon the ſquare muſcle of the Cheeke, which firſt ſuffereth convulſion in the diſeaſe called *Spaſmus Cynicus*, or the Dog laughter.

And thus much of the Nerues proceeding from the ſpinall marrow contained within the *vertebræ* or ſpondels of the necke, which we ſayde were ſeauen Coniugaions. It followeth now that we ſhould intreate of the nerues proceeding from the marrow of the rack bones of the Thorax or Cheſt. Of theſe there are as ſome thinke but eleauen Coniugations others reſolue of twelue, all which after their outlet are diuided into two branches, one greater, the other leſſer; one paſsing forward, another reflected backward.

Twelue paire of the Cheſt.

The firſt Coniugation [table 22, char.[8]] is ſnewed betwixt the ſeauenth bone of the Neck and the firſt of the Cheſt. It hath two branches, the firſt greater ſendeth certaine propagations to the ſhoulder blade [table 23,[αα]] to the firſt rib. [table 22,[y]] The ſecond leſſer [table 23,[u]] is diſſeminated into the adioyning muſcles.

The ſecond Coniugation [table 23, char.[9]] yſſueth betwixt the firſt and ſecond bone of the Cheſt; then it diſtributeth a branch backward, [table 23, [ϕ]] and after is ioyned with a branch

branch of the former Coniugation,[tab.23,ſ] & ſo paſſeth into the arme; that which remaineth of this Coniugation followeth the courſe of the firſt ribbe, and maketh an intercoſtall Nerue.

The 3.Coniugation as alſo all the other nine[table 22,from char.[10],to [20]] of the Cheſt are diſtributed after the ſame manner.For after they fall out of the ſides of the *vertebræ* they are diuided into two branches, one forward and another backward; the forward branches are called Intercoſtales, that is, *betwixt the ribs*,[table 22, nn] for from them many branches are diſſeminated into the Intercoſtall muſcles, [table 22, θθθ and the charracters of the left ſide] into the muſcles lying vpon the Cheſt,[table 22,θθ ιιxx] as the great and leſſer *Saw*, the pectorall and the broad Muſcle;[table 22,μμ] and are ſtrangely reflected to the veſſels thereabout. The backward branches leane backward to the ſpines or ſharpe points of the *vertebræ*, and are deriued into the muſcles which moue the backe of the Cheſt, and into the skinne of the backe; but their diſtribution is not in all men alike. The third and all the reſt.

Finally,the two laſt coniugations of the twelue do ſend Surcles [tab.22.at the ſides of the 18.and 19.Characters] to the head of the ſixt muſcle of the thigh.

From the ſpinall marrow contained in the racks of the loynes doe ariſe fiue coniugations greater then the former,deuided likewiſe after their out-gate into a forward & a backward branch, and from their backward branches [table 23, char.[52] and [53]] ſend ſurcles into the muſcles which grow to the *vertebræ* of the Loynes. The nerues of the Loynes fiue paire.

The firſt Coniugation [table 22,char.[20]] as alſo all the reſt yſſue out of the holes of the *vertebræ* vnder the *Peritonæum*, and is diuided into two branches, a greater and *anterior* partly aſcending to the *Diaphragma*, partly to the muſcles of the *Abdomen* or paunch;and a leſſer and *poſterior* which is reflected into the muſcles which leane vpon the *vertebræ* of the Loynes.

The ſecond Coniugation [table 22,char.[21]] runneth vnder the ſixt muſcle of the thighe and riſeth to the top of the haunch bone, but the forward branch is diſtributed to the ſixth internall Iliack, and the firſt bender of the legge. It ſendeth alſo a ſmall long nerue [table 22, char.[49]] accompaning the ſpermaticall veſſels of the ſame ſide euen vnto the Teſticle.

The third coniugation [Table 22. Char.[22]] yſſueth alſo vnder the Lumball muſcle; the fore-branch paſſeth neare the haunch-bone & is deuided into two propagations,one going to the knee the other accompanying the veine called *Saphena*; but the back braunch is reflected and diſſeminated into the muſcles, lying vpon the loynes and into the skin. So likewiſe from all the fore-branches of the three firſt coniugations certaine ſhootes[Table 22.at the ſides of the 20.21.22.Characters] do attaine to the coſtall nerue, and are ioyned therewith.

The fourth coniugation [Table 22.Char.23.] which is the biggeſt of all the coniugations of the loynes,accompanieth the veine and arterie to the groine,and diſtributeth certaine ſurcles to the forward muſcles of the thigh and the leg.

The fift coniugation [table 22.Char.24.] is parted in twaine as are the former. The fore-branch and the greater paſſeth through a hole betwixt the *Coxa*, the ſhare-bone and the hanch-bone and ſendeth diuers ſhootes to the muſcles of the thigh,the yarde, the neck of the wombe alſo and the bladder; but the backe-braunch is reflected to the muſcles,they leane vpon the *vertebræ* of the loynes and into the skin there abouts. Furthermore, theſe coniugations are tyed one vnto another,the firſt to the ſecond,the ſecond to the third, the third with the fourth, and the fourth with the fift, as is ſhewed in the firſt figure of the 22. Table.

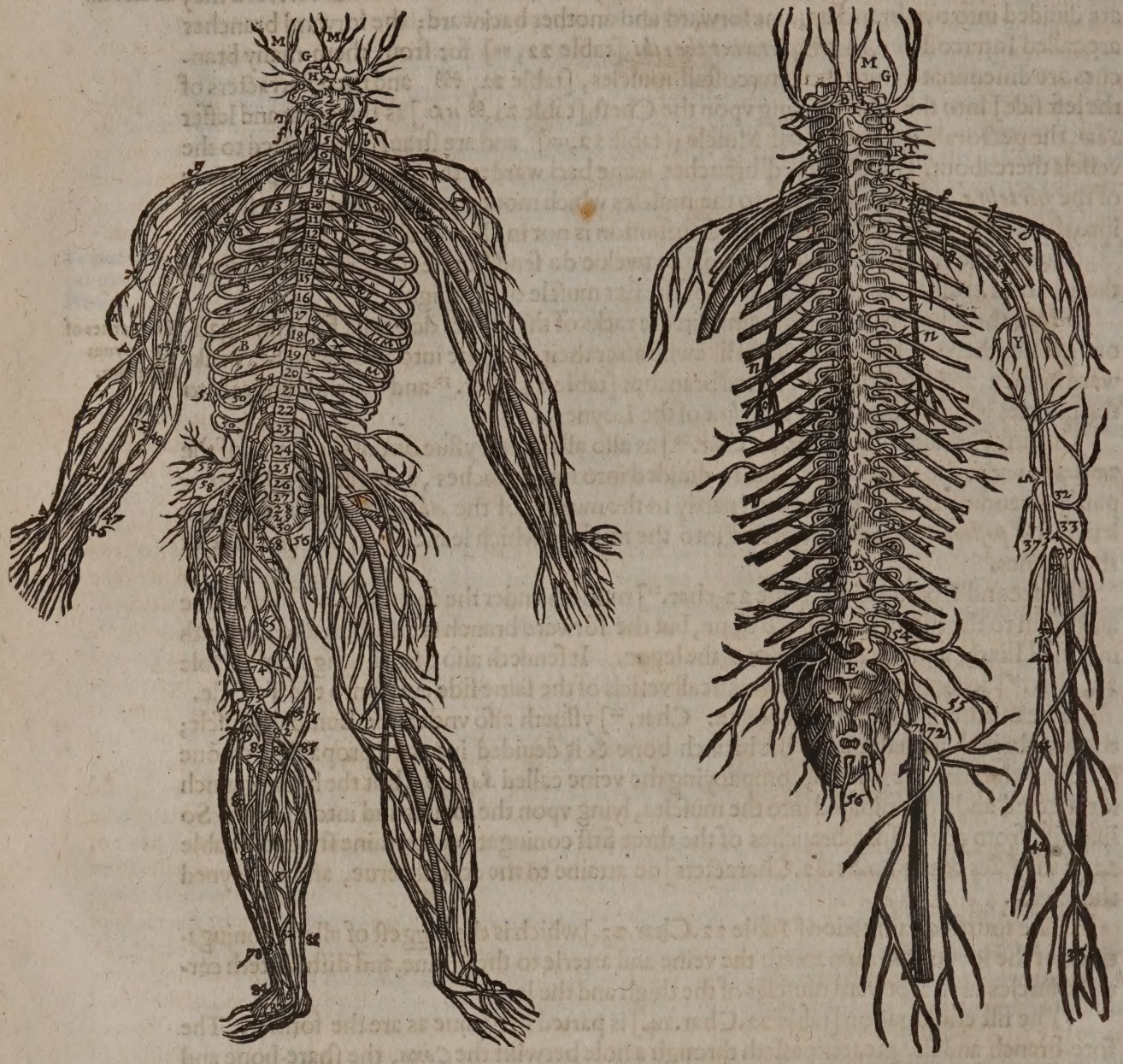
To conclude,out of the marrow conteyned in the *vertebræ* of the *Os ſacrũ* or holy-bone do proceed ſixe coniugations. The nerues of the *Os ſacrum*.

The firſt [Table 22.char.25.] yſſueth betwixt the laſt of the loyne and the firſt racke of the holy-bone, and is deuided into a fore-branch and a hind-branch; the fore-branch ſendeth a ſurcle [table 22.charact.[53]] into the inſide of the hanch-bone, from which certaine ſhoots are offered to the muſcles of the *Abdomen*,and the ſeuenth muſcle of the thigh.The back-braunch paſſeth in a like courſe as doe the backe branches of the other coniugations & a ſhoot beſide into the muſcles [table 23.charact.54.] produced from the haunch-bone, ſpecially into the firſt mouing the thigh,from whence it is conſumed into the skin.

The fiue other coniugations [table 22.from the 26.to the 30. chara.] are produced after another manner;for before they yſſue they are double on either ſide; one proceeding forward and another backward. Of the fore-branches the three vppermoſt runne to the leg, the The other fiue.

Table 22. and Table 23. Becauſe the ſame Characters belong to them both, we haue ſet them together.
Table 22. ſheweth the Racks of the ſpine and the nerues yſſuing there from on the foreſide.
Table 23. ſheweth the ſame Racks and Nerues on the backſide.

TABVLA XXII. & XXIII.



A 1,2, The ſpinall marrow as it goeth into the rack-bones. B C 2, The ſeauen *vertebræ* or racke bones of the neck. Character from 1,2, to 30. in the 15. table do ſhew the racks of the whole ſpine. C D 2, amongſt theſe the twelue racks of the Cheſt. D E 2, The fiue Racks of the Loynes. E 2. The holy bone. F 2, the hinder braunch of the firſt coniugation of ſinewes. G 1,2, the diſtribution of the ſame branch into the muſcles of the head. H 1, the forward branch of the firſt coniugation. I 2, a ſmall branch of the hinder propagation of the ſecond paire which is diſtributed vpward. K, a thicker brauach of the ſame nerue. L 2, the coition or coniunction of a branch of the third paire, with the branch of the ſecond paire marked with K. MM 1,2, the ſecond paire diſtributed vnto the skin of the head as far as to the neeke. N 1, the *anterior* branch of the ſecond paire. Character 3 in the firſt Table ſheweth the third coniugation and the third rack-bone. O 1,2, the hinder branch of the third paire reflected firſt backeward, then forward vnto the muſcles: & ſuch a reflection there is in all the nerues vnto char. 24. P 1, the *anterior* braunch of the third paire parted into foure. Q 1, the firſt going vnto the muſcles. R 1,2, the ſecond ioyning with the fourth paire. S 1, the third commixed with the branch K. T 1,2. the fourth branch going to the muſcles of that place. Character 4, in 1, the fourth coniugation of the fourth rackbone. V 1,2, the *poſterior* branch of the 4. paire. *X* 1,2, the *anterior* braunch of the 4. paire parted into three. Y 1, the firſt admitting the branch R. *a* 1, the 2 going to the muſcles. *b* 1, the 3 reaching to a part of the fift payre marked with *e*. Char. 5 in 1, the 5 paire. *c* 2, the *poſterior* branch of the 5. payre. *d* 1,2, the *anterior* brãch of the 5. paire. *e* 1, this portiõ maketh the nerue of the midriffe. *f* 1,2, a braunch of the nerue *d* creeping along the top of the ſhoulder, vnder which are certain ſurcles attaining to the ſhoulder blade. *g* 1,2,2 ſurcle of the nerue *f* deriued to the skin on the top of the ſhoulder. *h* 1,2, a ſurcle of the nerue *f* going to the ſecond muſcle of the arme. *i* 1,2, another branch inſerted into the ſame muſcle and the skin. Char, 6, in 1, the ſixt paire. *k* 2, the *poſterior* braunch of the ſame ſixt coniugation. *l* 1, the *anterior* braunch of the ſame coniugation. *m* 1, a ſurcle of the ſame nerue appointed to make vp the

ſinew

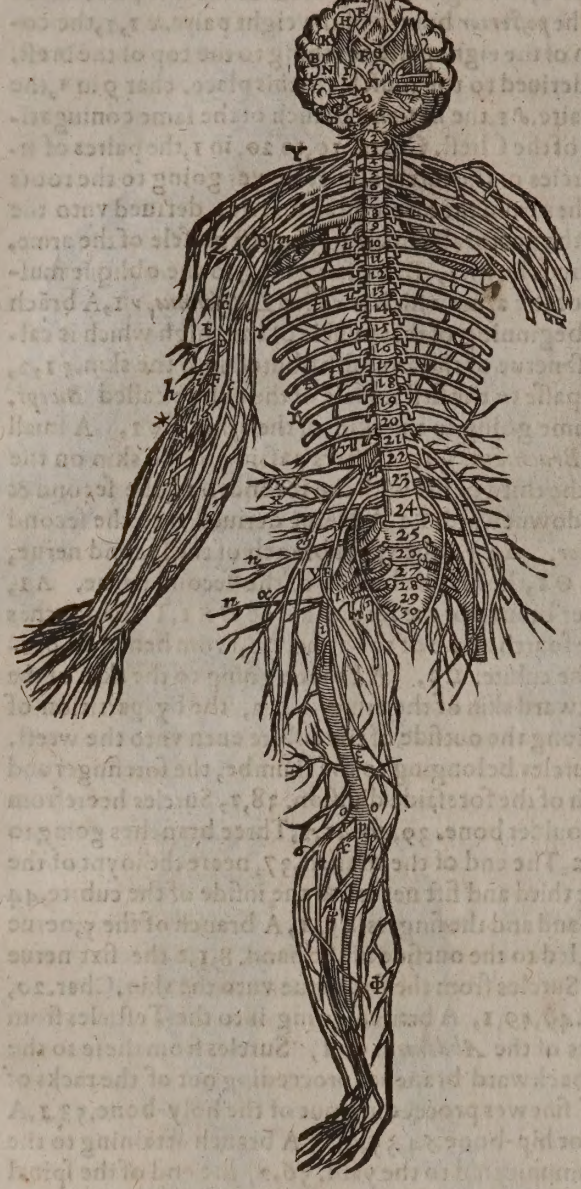
Sinew of the midriffe. *n* 1,2, the nerue of the midriffe made of three ſurcles, *b*,*b*, and *m*. *oo* 1,2, the inſertion of this nerue into the midriffe. *p* 2, A branch of the ſixt coniugation running to the cauity of the ſhoulder blade. *q* 1,2, the coniunction or implication of the branch *l* with the branches neighbouring about it. Char 7 in 1, the ſeauenth coniugation of ſinewes. *r* 2, the *poſterior* branch of the ſeauenth paire. *ſ* 1, the congreſſe or meeting of the ſeauenth coniugation with the branches that are neere it. *tt* 2, Surcles of this nerue deriued to the muſcles of the ſhoulder blade and the arme. char 8. in 1, the eight coniugation or the firſt paire of the Cheſt running aboue the firſt rack-bone of the Cheſt. *u* 2, the *poſterior* branch of the eight paire. *x* 1,2, the coition or coniunction of the 8. paire with the 7. *y* 1, A brãch of the eight paire reaching to the top of the breſt. *αα* 2, Surcles proceeding from the eight coniugation and deriued to the muſcles in this place. char 9 in 1, the ninth paire of nerues. *β* 2, the *poſterior* branch of the ninth paire. *δ* 1, the *anterior* branch of the ſame coniugation. *ζ*, 1 Surcles from this branch to the diſtances or ſpaces of the Cheſt. Chara. 10, to 20, in 1, the paires of ſinewes deriued to the diſtances betwixt the ribs. *mm* 1, Surcles of the intercoſtall ſinewes going to the roots of the ribs and increaſing the *coſtall* nerues. *θθθ* 1, Branches from the intercoſtall ſinewes deriued vnto the muſcles which lye vpon the Cheſt. *ιι*, 1 Branches going to the pectorall muſcle or the firſt muſcle of the arme. *κκ* 1, Other branches going to the lower ſide of the ſame muſcle. *λλ* 1, Branches going to the oblique muſcles of the *Abdomen*. *μμ* 1, Others deriued to that muſcle of the arme which is called *Latiſſimus*. *ν* 1, A brãch paſsing vnto the Pap. *οο* 1, Branches from 18, & 19, to the beginning of that muſcle of the thigh which is called *Lumbalis* or the ſixt muſcle of the Thigh. *ππ* 1, the firſt nerue of the arme diſtributed into the skin. *ρ* 1,2, the ſecond nerue of the arme. *σσ*, 1, From this doe nerues paſſe to the firſt muſcle of the cubite called *Biceps*. *τ* 1,2, The third nerue of the arme. *υ* 1,2, A branch of the ſame going to the skin of the arme. *φ* 1, A ſmall branch deriued to the ſecond muſcle of the cubite called *Brachiæus*. *χ* 1, Others paſsing to the skin on the foreſide of the arme. *ψ* 1, the congreſſe or coniunction of the third nerue with the ſecond. *ω* 1, the ſecond & the third nerues after their coniunction doe heere creepe downeward. Γ 1, A Nerue deriued vnto the ſecond muſcle of the *Radius* which muſcle is called *Supinator longior*, ΔΔ 1, the vpper branch of the ſecond nerue, running to the wreſt and to the firſt ioynt of the thumbe. Θ 1, the middle branch of the ſecond nerue, Λ 1, the progreſſe of the ſame euen vnto the hand. Ξ 1, the lower branch of the ſecond nerue. ΠΣ 1, Two branches of the ſame nerue going to the inſide of the hand. Φ 1,2, the fourth nerue of the arme. Υ 2, From hence do proceede nerues to the muſcles which extend or ſtretch out the cubite. Ω 2, A branch going to the skin of the arme on the backſide. 32, 2 Branches deriued to the outward skin of the arme. 34,2, the by-partition of the fourth nerue at the cubite. 33,2, A branch creeping along the outſide of the cubite euen vnto the wreſt. 35, 2, The vpper branch of the foreſaide diuiſion. 36,2, Surcles belonging to the thumbe, the forefinger and the middle finger on their outſides. 37,2, the lower branch of the foreſaide diuiſion. 38,2, Surcles heerefrom to the muſcles ariſing out of the externall bunch of the ſhoulder bone. 39,40,41,2, Three branches going to the muſcles which ſpring from the bone called *Vlna*. 42,2, The end of the branch, 37, neere the ioynt of the wreſt. * 1,2, The fift nerue of the arme. 43,1, Surcles of the third and fift nerues to the inſide of the cubite, 44 1, A branch of the third nerue going to the palme of the hand and the fingers. 45, 1, A branch of the 5, nerue to the inſide of the hand. 46,1, A Surcle of the branch 45, led to the outſide of the hand. 8,1,2, the ſixt nerue of the arme. 47,1, the end thereof next the ioynt. 48,48,1, Surcles from the ſixt nerue vnto the skin. Char. 20, to 24,1, Nerues proceeding out of the racks of the loynes. 49,49,1, A branch going into the Teſticles from the 20 paire. 50,50,1, The nerues belonging to the muſcles of the *Abdomen*. 51,1, Surcles from theſe to the broad muſcle of the arme called *Latiſſimus*. 52,52,2, The backward branches proceeding out of the racks of the Loynes. Char 25, to 30, The coniugations or paires of ſinewes proceeding out of the holy-bone. 53,1, A branch of the 25 paire going to the inſide of the *coxendix* or hip-bone. 54,55,2, A branch attaining to the outſide of the *coxendix*. * 2, Hence proceedeth a nerue communicated to the yard. 56,2, the end of the ſpinal marrow. 57,1, The firſt nerue of the Leg. 58,1, Brãches here from to the skin. 59,1, Other brãches herefrom to the muſcles. 60,1, The 2. nerue of the Leg. 61,61,1. Brãches herefrom to the skin. 62,1, A brãch deſceeding to the top of the foot. 63,1. Branches from 61, compaſsing the knee. 64,1, A branch of the 2. nerue going to the muſcles. 65,1 A brãch here-from going to the fift muſcle of the thigh cald *Triceps*. 66 1, the nerue of the Leg. 67, 1, A ſurcle creeping to the hole of the ſhare-bone. 68,1 A branch allowed to the skin on the inſide of the thigh. 69,1. A portion of the third nerue going to the muſcles. 70,1, A portiõ hereof communicated to the 2. muſcle which bendeth the leg or *Tibia*. 71,1,2, The fourth nerue of the leg. 72,1,2, A branch heereof communicated to the skin of the thigh in the backpart. 73,1, Another to the muſcles which ariſe from the *Coxendix*. 74,1, A branch allowed to the fourth muſcle of the *Tibia* or leg and to the skin. 75,1, Surcles from the fourth to the heads of the muſcles of the foote. 76,1, The diuiſion of the fourth nerue in the Ham into two Trunkes. 77,1, the outward trunke. 78,78,1, A branch heere from to the skin of the leg or *Tibia* on the outſide as farre as to the little toe. 79,1, Another branch inſerted into the muſcles. 80,1, A branch diſperſed into the skin of the foreſide of the leg from the branch. 79 81,1, A part of the branch. 79, going to the muſcles of the foote. 82,1, the inner trunke of the fourth Nerue. 83,83,1. A branch creeping along the inſide of the legge vnder the skin. 84,1. A branch of the Trunke, 82, diſpoſed vnder the skin to the back-ſide of the Calfe of the legge. 85. 85. 1, A branch of the trunke, 82, creeping along the foreſide of the legge to the vpper part of the foote. 86, 1, A branch of the trunke 82, paſsing along the backſide of the legge and diſtributed to the muſcles. 87, 1, The remainder of the inner trunke allowed to the Toes.

the two lowermoſt are diuerſly diſtributed into the muſcles of the Fundament & the Bladder and parts thereabouts. But the back-branches [table 23. char. 54. and 55] are diſtributed into the muſcles on the backſide of the hanch and holy bones, and into the skin of the buttocks.

Finally,

Table 24. sheweth the Braine together with the After-braine, the spinall marrowe and the nerues of the whole body.

TABVLA. XXIIII.



A, that part of the brain that is next the nosethrils.
B, that part which is at the side of the ventricles.
C, the backpart of the braine.
D, the *Cerebellum* or After-braine.
E, the Mamillary processe on the right side.
F, the originall of the opticke nerue.
G, their coniunctions.
H, The coate into which the optick nerue is extended.
I, the second paire of the sinewes of the braine.
K, the lesser roote of the third coniugation.
L, the thick roote of the same coniugation according to the common opinion.
M, the fourth coniugation of sinewes.
N, the lesser roote of the fift paire.
O, the bigger roote of the same paire.
P, The small membrane of the eare which they call the *Tympanie*.
Q the lower branch of the bigger roote of the fift coniugation.
S, the sixt paire of sinewes.
T, the seauenth paire.
V, the beginning of the spinall marrow out of the middle of the Basis of the braine.
X, the right sinewe of the midriffe cut off.
Y, a branch from the fist paire creeping to the top of the shoulder.
Z, the first nerue of the arme from whence there goeth a branch to the skin.
A, the second nerue of the arme, and a branch therefrom into the first muscle of the Cubite.
B, the third nerue of the arme and a branch going to the skin on the outside.
C, a branch from the third nerue to the second muscle of the Cubite.
D, the congresse or meeting of the second nerue with the third.
E, a small branch from the third nerue to the second muscle of the *Radius*.
F, the distribution of the second nerue into two branches
* The lesser branch of this diuision lengthened out to the skin as far as the thumbe.
a, the place of the spinall marrow where it yssueth out of the braine.

1,2,3, &c. Thirty paire of nerues arising from the spinall marrow are here noted by their Characters, that is to say, seauen of the necke, twelue of the Chest, fiue of the loynes, and sixe of the holy-bone.
b, the thicker branch of the second nerue deuided into two parts. *c*, Braunches of the third nerue sprinkled here and there. *d*, Nerues from the third paire to the thumb, the forefinger and the middle finger. *ee*, the 4. nerue of the arme. *f*, the passage hereof through the inside of the shoulder. *g*, a tripartition of this braunch where it toucheth the Cubite. *h h*, a branch distributed from the fourth nerue to the outward skinne of the Cubite. *i*, the vpper branch of the deuision of the fourth nerue, *kk* a branch of *i* reaching to the outside of the hand. *l l*, the lower branch of the diuision of the 4. nerue passing through the backeside of the Cubite. *m*, the fift nerue of the arme. *n*, branches of this nerue dispersed here and there. *o o*, a branch of the 5. nerue reaching to the inside of the hand and the fingers. *p*, a surcle of the braunch *o* deriued to the outside of the hand and the fingers. *qq*, the 6. nerue of the arme and the course thereof vnder the skin. *rr*, the Intercostall nerues, there cut off where they are together with the ribs reflected forward. *ſſ*, branches on each side running backward. *t t*, nerues attaining vnto the cheſt. *uu*, the commixtion of the nerues *rr* with the descending branch of the sixt coniugation of the braine. *xx*, nerues from the loynes led vnto this place. *y*, a branch going to the testicle here cut off. *z*, a nerue reaching to the first muscle of the thigh. *ε*, the first nerue of the leg. *αβ*, a surcle of the former nerue deriued to the skin at *α* and inserted into the muscles at *β*. *γ*, the 2. nerue of the leg. *δδδ*, a nerue from the former, allowed vnto the skin as low as to the foot, & passing along the inside of the leg. *ε*, a branch of the 2. nerue running vnto the muscles. *ζ*, the third nerue of the leg. *η*, a surcle thereof vnto the skin. *θ*, another surcle vnto the muscles. *ι ι*, the 4. nerue of the leg. *κκ*, the *anterior* propagations of the nerues proceeding from the holy-bone. *λ*, the end of the spinall marrow. *μ*, a branch from the 4. nerue inserted into the muscles arising from the *Coxendix* or hip bone. *ν*, another branch going to the skin of the thigh on the backside. *ξ*, a propagation deriued to the 4. muscle of the leg & to the skin of the knee. *οο*, nerues attaining to the heads of the muscles of the foote. *πρ*, the deuision of the 4. crurall nerue into two trunks. *σ*, a branch from the trunk *π* dispersed into the outward skin of the leg. *τ*, a surcle of the trunk *π* deriued to the muscles. *υ*, another surcle to the skin of the leg on the foreside. *φ*, a branch of the trunk *ρ* to the skin of the inside of the leg & of the foot. *χ*, a surcle of the trūk *ρ* to the hindmost skin of the leg. *ψ*, a brāch of the whole trunk *ρ* led along to the forward part of the leg & the foot. *ω*, the descēt of the trūk *ρ* into the foot.

Final'y, the end of the ſpinall marrow [table 22.and 23. char.56.] proceeding from the holy-bone ſendeth one propagation on either ſide, which is ſometimes diuerſly diuaricated and diſſeminated into the fourth muſcle of the thigh, and the skinne betwixt the buttocks and the fundament. Notwithſtanding in Dogs and Apes there are three coniugations proceeding out of the Coccyx or rump-bone.

Wherefore to ſumme vp all, we muſt remember that the ſpinall marrow hath 30.paire or coniugations of ſinewes; ſeauen belonging to the marrow of the necke, twelue to the marrow of the backe, fiue to the marrow of the loynes and ſixe to the marrow of the holy-bone: all which it is very neceſſary a Phyſition and Surgion ſhould know, that hee may be able to apply Oyntments, Cataplaſmes and ſuch like to the proper parts of the ſpine, when the nowle of the head, the face, the necke, the hands, the parts of the Cheſt, the muſcles of the *Abdomen*, the wombe, the bladder, the fundament, the yard or the legges are depriued of Sence or Motion or both together. The vſe of this chapter.

CHAP. XXII. *Varolius his manner of diſſecting the Head.*

THere is in the body of man ſo great variety of all manner of parts, that it is impoſsible to follow the trace of Nature by humane diligence ſo neerly that a man ſhall not ſometimes wander out of his way or be at loſſe. It is therefore no wonder if the ancient and firſt Anatomiſts (men queſtionleſſe very oculate and ſharp ſighted) did not yet attaine to the exquiſite knowledge of all particulars, but left many thinges to bee found out and perfected by their Succeſſours. Nay we aſſure our ſelues that no proceſſe of time, diligence of inquiſition or helps of other mens labours ſhall euer be able to bring Anatomy to ſuch perfection, but that there will be place left for them that come after to finde out ſomething neuer before diſcouered; ſo like is this little world of mans body to the great globe of the Vniuerſe, wherein euery day new Countries and Nations, yea populous and rich ſtates and Common-wealthes are by Trauellers found out. An inſtance hereof in the Art we haue in hand is *Conſtantinus, Varolius*, who in the yeare 1570. inuented a new manner of diſſection of the braine, which how it is accõpliſhed as we haue partly learned by his Epiſtles written *An.*1573. partly by our own diſſections ſaith *Bauhine*, for theſe 24.yeares together we will here relate, becauſe it doth better exhibite the true originall of the ſpinall marrow and the nerues proceeding there from, as alſo the ſtructure of the ventricles for our better ſatisfaction in the cauſes of the deſeaſes of the head and the explayning of ſome paſſages in *Hippocrates* and *Galen*. *Varolius* his inuention.

The difference betwixt theſe two Adminiſtrations is; that in the former, the vpper parts of the skull and the Meninges of the braine being remoued, the contayned parts are layde open to the view. But in this which is full of labour and difficulty, the bones of the head are on euery ſide remoued; and the parts contained within the skull yet couered with both the membranes hauing the eyes, the coniugations of the ſinewes and the ſpinall marrow ioyned thereto; are at one view repreſented and the ſection begun at the Baſis of the brain. But for this Adminiſtration the head muſt be greene and not wateriſh, otherwiſe we ſhall looſe our labour: you muſt therefore take the head of a man newly cutte off, or for want thereof a Calues head will ſerue the turne, becauſe all the particulars may bee therein diſcerned. How admniſtred.

Of the Spinall Marrow.

Firſt of all wee muſt begin at the *Spinall Marrow* which they ſay ariſeth from the lower Baſis of the braine at the great hole of the *occipitium* or nowle bone. [table 25. fig. 1. from [D] to [E]] This is eſtabliſhed within the skul in his proper ſeat and is compaſſed or inueſted with the membranes: wherefore after the thicke Meninx is remoued, the other called *pia mater* is alſo to be taken away, which is tranſparant and ſtrong, & by whoſe mediation the forepart of the marrow is tyed to the braine and the hind part to the After-brain. It alſo detayneth or eſtabliſheth the ſpinall marrow that it be not reflected backward, which haply is the cauſe why Anatomiſts haue not knowne his true originall; for if you take it vp with a hooke and lightly remooue it with a knife from the partes vnder it, and bend the ſpinall marrow ſomewhat forward [Table 25. figure 2.[a b]] then will his originall ſhew it ſelfe to be not in the *occipitium* or where it was firſt tyed to that thin membrane, but aſcending ſomeſomewhat vpward and in the forepart of the braine. The adminiſtratiõ of the ſpinall marrow.

This Marrow therefore conſiſteth of foure roots, whereof the two greater [Tab. 25, fig. 2, [b c] ſheweth the trunke reflected, Char. 4. and 1. ſhew the trunke in his owne ſeate] The 4 rootes thereof.

do yſſue out of two parts of the Braine in that place wherein the Ventricles are reflected [Tab. 25. fig. 2. f g] from the forward prominence or ſwelling of the brain vnto the middle, & whereabout the Opticke Nerue [Tab. 25. fig. 2. c d] paſſeth without the ventricle.

Where ioined

The other two Roots are two ſhort trunkes of the *Cerebellum* [Tab. 25. fig. 2. cha. 6] ariſing on either ſide out of the vpper part thereof, which are ioyned to the two greater productions of the Braine euen now ſpoken of, [Tab. 25. fig. 2. betwixt the two characters 2 and 3] and ſo of foure are made two, [Tab. 25. fig. 1, g] which afterward do accompliſh the ſpinall Marrow, from which all the Nerues of the whole body haue their originall as diligent inſpection doth ſufficiently prooue.

Galen acknoledgeth the truth of this.

And the ſame *Galen* affirmeth in the 13. chap. of his 8. Booke *de vſu partium* and in many other places where he ſaith, That all the Nerues which are attributed to the ſpinal Marrow do ariſe from the After-braine, ſo that according to his Anatomy the ſpinall Marrow is ioyned to the *Cerebellum*.

He is taxed by *Columbus*. Redeemed by *Varolius*.

Some there are and *Columbus* among the reſt, who heerein taxe *Galen*, affirming that no Nerue proceedeth from the *Cerebellum*. But, ſaith *Varolius*, *Galens* opinion may be after ſome ſort maintained to be true; but thoſe that find fault with him affirme that which is abſolutely falſe, becauſe the ſpinall marrow ariſeth out of two roots of the brain whēce two paire of ſinnewes are produced, and out of two roots of the After-braine which are ioyned to the former and do together fulfill or accompliſh the ſpinall Marrow; and ſo all the Nerues of the ſpinall Marrow do ariſe out of the *Cerebellum*.

Why the originals of the ſinnews grow into one.

And verily that this ſhould bee thus, it was profitable yea neceſſary; for the principles or originals of all things had neede to bee firme and ſtable. Now by how much any thing is more ſingle and ſimple, by ſo much without doubt it is more ſolid and firme; wherefore it behooued that the originall of all the ſinnewes ſhould be but one ſimple and ſingle originall. For if all the Arteries and Veines be reduced to one originall, the Arteries to the Heart, the Veines to the Liuer; it is agreeable to the wiſedome of Nature that the Nerues alſo ſhould proceede from one originall; becauſe theſe are three common Organs or Inſtruments of the body through which the Animall, Vitall and Naturall Faculties are by the helpe of ſpirites tranſported together with the vitall & naturall blood. And this both *Hippocrates* & *Plato* ſeeme to haue known.

Hipp. & *Plato* inſinuate ſo much,

Hippocrates who in the beginning of his Booke *De Natura Oſsium* writeth, that the Originall of Sinnewes is from the *Occipitium* which is the ſeate of the After-brain. And *Plato in Timæo* ſpeaking of all the Sinnewes writeth, that God diſpoſed the Nerues about the lower part of the Head, and compaſſed them with a ſpinal Marrow, which is of a ſubſtance like vnto theirs.

why the ſpinal marow ariſeth out of the cēter of the braine.

Now the originall of the ſpinall marrow was to bee out of the middle part of the Braine, [Tab. 25. fig. 2. b c, and character 4. do manifeſtly ſhew it] becauſe through it as it were through a common water-courſe the ſpirits which are perfected in the middeſt of the Braine were to be deriued into other Riuerets and ſo into the whole body. Wherefore their beginning was to bee placed in the center of the Braine neere the Store-houſe or ſhop of the ſpirits, whence they might receiue them as it were with a ful ſtreame; like as Anatomy teacheth vs, that the Arteries and the Veines do ariſe out of the middle of the Heart and the Liuer.

Obiection.

It will be obiected, that this Trunke which heere we call the Spinal marrow ought not to haue that denomination till it haue attained into the *Vertebræ* or racke-bones of the Chine, and therefore it is improperly ſaide that the Opticke Nerues doe ariſe from the Spinall Marrow. We anſwere, that we haue before ſufficiently ſatisfied this doubte in the 15. chapter of this Booke, yet for further contentment (if they will bee contented with reaſon) we anſwere by inſtance; doe not the Nerues of the Sight, Hearing and of the reſt of the ſenſes receyue their names from the Organes to which they are deſtinated before they touch thoſe Organes? yea whilſt they remaine within the ſcull? So alſo this Marrow may be called the Marrow of the backe or the Spinall Marrow before it enter into the Spine. For whilſt it remaineth within the ſcull it is diuided from the Braine, and in it may be obſerued proper Fibres belonging to it ſelfe alone.

Anſwere by inſtance.

Of the After-Braine or Cerebellum.

After we haue done with the ſpinall Marrow wee muſt come vnto the *Cerebellum* [Tab. 25. Fig. 1. BB. fig. 2. Ch. 8, 9, 10] bared from the Membranes, which beſide two proceſſes called *Vermi-formes* which are parts of the ſubſtance therof, and beſide the two lateral parts

which

Table 25. Fig. 1. sheweth the Braine taken out of the Scul separated from the Dura Meninx and inuerted, whose right side exhibiteth the Originall of the Spinal Marrow and the seauen Coniugations of the Sinnewes of the Braine, according to the ordinary receiued opinion: but the left side sheweth their true originals.

Fig. 2. sheweth the Braine inuerted, & the partes thereof in the Basis distracted, as also the Originall of the Spinall Marrow out of the braine and the After-braine, the largenesse of the Ventricle, and the originall of the Opticke Nerue out of the Marrow.

TABVLA. XXV.

FIG. I.

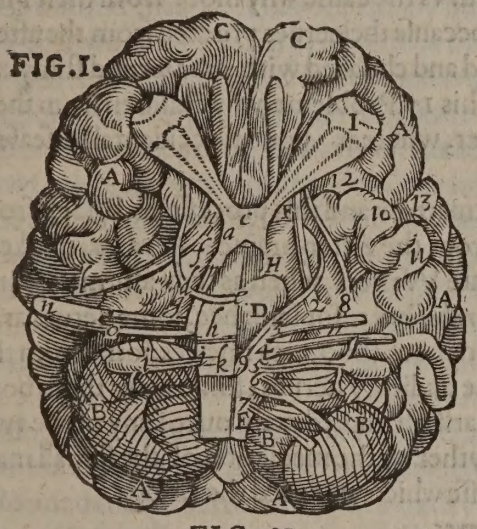
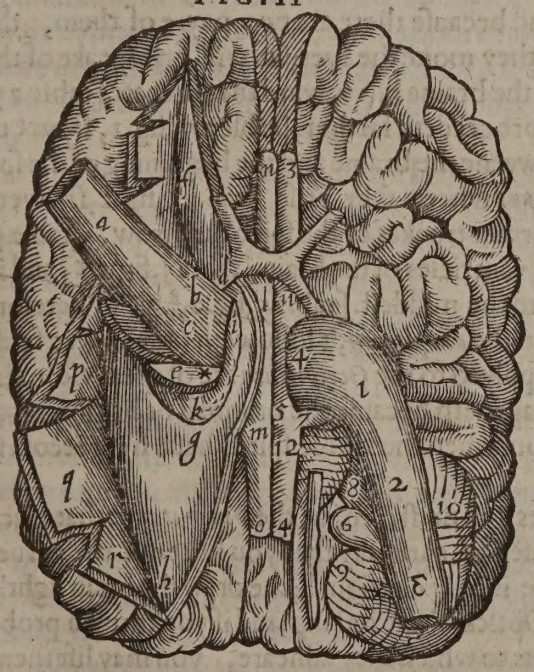


FIG. II



A A A. The Braine.

BBB, the After-brain.

CC, the swellings of the braine commonly cald the *Mamillarie* processes.

D, the beginning of the Marrow of the back, as it is commonly beleued.

E, the termination or end thereof in the Scull.

F, the originall of the Organes of smelling according to the vulgar opinion.

H, the originall of the Opticke Nerues, as it is commonlie receiued.

I, the coate into which the Opticke Nerue is inserted.

2. The second paire of sinnewes.

3,4,5,6,7. The coniugations of the sinnewes, whose Originall *Vesalius* himselfe attributeth to the beginning of the Spinal Marrow.

8. A branch of the third coniugation as Anatomistes doe beleeue which passeth forward, but we take it to be the third Coniugation.

9, A branch of the fift coniugation according to *Vesalius*, but we esteem it to be a coniugation of it self, and therefore cal it the eight paire.

10,11,12,13. The barke or shell of the Braine; for 8,9, 10, 11. is the verie marrow of the Braine it selfe, and these two are not cõtinual but only contiguous, or touching one another.

a,b. The whole Optick Nerue, and at *b.* is the reflection of the Nerue to the back-part of the Spinall Marrow.

c, The coition or concurse of the Optick Nerues.

d e. A part of the second Nerue not commonly knowne, whose originall is at *e.*

f,g,h. The Marrow of the Braine lengthened and determining in the spinall Marrow.

k. The transuerse processe of the After-braine which is called the *Bridge.*

i,i. the Auditorie Nerue arising out of this processe.

l,m. the passage of the Organ of smelling lurking between the vpper and middle prominence of the Braine, and at *l.* is his originall.

n, the middle prominence of the Braine diuided from the rest of the Braine.

o, the beginning of the backward prominence of the brain from whence the middle was dissected.

p, the intercussation which the Optick Nerue maketh with the Nerue that mooueth the eye.

The Second Figure.

1,2,3. The halfe of the Spinall marrow drawn to one side.

4,5. the coniunction of the same marrow with the ventricle

6. A portion of the spinall marrow growing out of the After-brain.

7. the Optick Nerue reflected in the backpart of the spinall marrow and entering into the cauity of the Ventricle.

8,9,10. the lefte side of the After-braine from which the right side is remooued.

11,12. A slit going vnto the second Ventricle, vvhich slit is formed partly by the bodie of the Arch, partly from the inner part of the Spinall Marrow.

13,14. The Coniunction of the right and the left sides of the Braine by the Callous body.

a. The right part of the Spinall Marrow reflected vpward to his owne side, that so the originall therof which is in the cauity of the Ventricle might be perceyued. *c,b.* The beginning of this Marrow as it respecteth the hollownesse of the Ventricle. *d,e.* The Optick Nerue reflected about the roote of the Spinall Marrow. * The first originall of the Optick Nerue. *f g,h.* The whole Cauity of the Ventricle, *f* sheweth the Anterior, *g* the middle, and *h* the Posterior Cauity hollowed in the Braine. *i,k.* The complication of vessels cald *Plexus Choroides* about the roote of the spinall Marrow in the ventricle. *l,m.* A portion of the *Basis* of the brain which together with the Spinall Marrow maketh the cleft which entreth into the ventricle. *n, o.* the length of the callous body which ioyneth together the two sides of the Braine. *p,q,r.* Portions of the braine reflected backward that the cauity of the ventricle might better be perceyued.

which resemble two bowles closed together, of which wee spake sufficiently before in the 14. chapter of this booke: there remaineth yet another processe thereof to be exhibited & manifested vnto you.

The processe called the Bridge.

This processe is a very notable one, [tab. 25, figure. 1, k] arising on eyther side out of the *Cerebellum* neere the trunks wherof the spinall marrow is amassed, and runneth ouerthwart forward and downeward, by the mediation whereof this After-braine imbraceth the fore-part of the spinall marrow after the same manner that the transuersall or ouerthwart muscles of the *Larynx* making the third paire of common muscles doth imbrace the back-part of the beginning of the *œsophagus* or Gullet and thence are called *œsophagæi*: and this processe is distinguished by a course of ouerthwart fibres with a kinde of eminency from the right fibres of the spinall marrow.

This processe *Varollius* calleth *pontem Cerebelli*, the bridge of the After-braine, from the similitude it hath with a bridge, because vnder it the spinall marrow runneth as a streame runneth vnder a bridge.

How the auditory nerue ariseth out of the Bridge.

At this processe the *nerue of hearing* hangeth and hence ariseth, [table 25, fig. 1, ii] so that we may boldly auouch that the *Cerebellum* is also the first originall of the sense of hearing. And this beginning of the auditory nerue teacheth vs the cause why more from their infancy are deaf then destitute of any other sense; for because the nerues proceed from the after-brain and run no long course, they are easily filled and choaked with *Mucous* and slimy excrements; & this is the reason, as saith *Cassius* in his 17 Probleme, why children from their infancy loose their hearing of both eares together, whereas vpon an accidentall disease it is more vsuall to haue one alone vitiated.

Two pretty questions resolued.

Seeing therefore almost halfe of the spinall marrow and this processe or bridge from which the auditory nerue ariseth do proceede from the After-braine; *Varollius* thinketh that *Galen* hath great wrong to be taxed by the late Writers, when as they affirme against him, that no nerue hath his originall from the *Cerebellum*: for saith hee, some nerues arise onely from the braine and not from the After-braine as the optick sinewes; some from the After-braine only and not from the braine as the auditory nerues; some from them both together as the nerues of the spine: but no nerue ariseth immediately out of any of the two principles but all out of their owne principles eyther by the mediation of the spinall marrow or by the mediation of that transuerse processe which we called the Bridge.

Galen iniured by the *Neoterickes*.

Varollius.

Of the Nerues of the eyes.

Next followeth the nerues of the eyes, and because there are two payre of them, the one called *optici*, the other *motorij* because they moue the eyes; we will first speake of the *opticks*. They say they arise out of the basis of the braine but toward the forepart, [table 25, fig. 1, i] whereas indeed a great part of them proceedeth farther, [table 25, fig. 1, from p to b] and lurking in a certaine space formed betweene the braine and the beginning of the spinall marrow, they runne out toward the *occiput* where they arise [tab. 25, fig. 2, sheweth their originall] out of the beginning of the former trunkes of the spinall marrow, [tab. 25, fig. 2, b c] where they respect the cauity of the ventricles of the brain, [tab. 25, fig. 2, g] and in the backpart thereof they are reflected toward the middest. [tab. 25, fig. 2, d e] Wherefore seeing the originall of these nerues is almost in the *occipitium*, it followeth (as also wee finde it true by daily experience) that Cauteries applyed to the *Occipitium* are of great vse in the diseases of the eyes: which out of question hapeneth because the originall or beginning of the opticke sinewes being depurated and confirmed the visible spirits haue freer recourse vnto the eyes.

The common receiued originall.

The true originall.

Why Cauteries at the necke helpe the eyes.

If you would demonstrate these sinewes you must remoue the *Pia mater* at that place where the Opticks are commonly saide to arise; but carefully that you hurt not the nerue, & then you may perceiue that the brain there is only contiguall; then draw the brain lightly forward from the marrow till you finde the Opticks there lurking, and if you thrust a probe without violence betweene them and the parts to which they adheare, you may lift them from the subiected parts till you come to their originall, and withall you shall perceiue where the spinall marrow taketh his beginning out of the braine. They say commonly that the mouing nerues [ta. 25, fi. 1, Ch. 2] haue their beginning neere the Opticks, a little more outward; but if you dissect a part of the brain toward the midst you shal perceiue them distinguished from the brain to attaine to the middle of the head & to passe vnder the Opticks after they haue made an intercusion, [Table. 25, figure. 1, d] that is, haue crossed one the other, and do arise at the inner part of the beginning of the spinall martow, [Table. 25, fig.

How to demonstrate the Opticke nerues.

The mouing nerues.

figure 1.[c]] and in their originall are so vnited that they touch one another in one corner, which haply is the cause why both the eyes are together moued to the same side. Why both eies moue together.

That the rest of the coniugations of the sinewes of the braine do yssue from the Spinall marrow, *Vesalius* is content to affirme, excepting onely the third. *Columbus* acknowledgeth that third with all the subsequent coniugations to arise from the said marrow, and for the two first paires we haue euen now proued their originall: it remaineth that we proceed to the instruments of smelling.

The instruments of Smelling or the Mammillary processes.

The instruments of smelling or the *anterior* processes of the braine which proceed outward betwixt the optick nerues vnto the fissure of the spongie-bone scituated at the toppe of the nose, are commonly esteemed to arise out of the Basis of the braine [tab. 25. fig. 1.[f]] neare the coniunction of the opticke nerues [Tab. 25. fig. 1.[c].] But the truth is, that Anatomists hitherto haue shewed onely the one halfe of these instruments; for beside that they doe shew [table 25. figu. 1. from [m] forward] they proceede as much more [Table 25. figure 1. from [m] to [l]] lurking betwixt the forward and the middle swelling of the braine, for their progresse is backeward, and by how much they reach further, by so much is the distance more betwixt them. They are also by little and little attenuated, growing thinne vntill they determine into a sharpe poynte at the sides of the braine almost at the vtmost limite thereof [Table 25. figure 1. at n] which is aboue the holes where the ayre beateth into the eare, for this is the place of their originall. And hence haply it is that if the smelling bee intercepted; the hearing also is somwhat affected; for we see that when vpon a cold or murr (as we cal it) the nose is stopped and the smell hindred, the hearing also is somewhat offended: wee also manifestly perceiue that when wee sneeze or blowe our nose or retayne our breath by shutting vp our nosthrils, the hearing is also instantly interrupted, and those that loose their smell doe verie easily become deafe: it may also bee that from this sympathy that Probleme of *Aristotle* the fift of the 11. Section, and the 23 of *Cassius*, *Why those that be deafe do speake through the nose* may be assoyled. Their cõmon receiued originall. Their true originall. Of the simpathy between hearing and smelling.

Of the Ventricles of the Brain.

These things being thus demonstrated, and the eyes with the optick nerues being drawn each into their owne side, you must lengthwise cut into two partes the bridge of the *Cerebellum* and the spinall marrow, then must you remoue the *Cerebellum* quite away, and one part of the spinall marrow so deuided lengthwise as we sayde before must be drawne to his owne side, and one side of the braine both before and behind must be cut to shew the magnitude and figure of the ventricles thereof, for this Administration sheweth a great difference in the scite, magnitude, forme, number and vse of them from the common demonstration. How we must proceed in this kind of section.

The receiued opinion is that there are foure ventricles, *Arantius* in his obseruations accounteth six; foure acknowledged by the antients and vnder these two other; but indeed and trueth by how much the number is increased, by so much is the error the greater, there being in trueth but two, for the braine both of man and beasts being double, as first *Hippocrates* obserued in his Booke of the *Falling sicknes*, and after him *Aristotle* in the 10. chapter of his fourth booke *de Historia Animalium*, it seemeth æquall that each part should haue a ventricle. For these two which they place in the forepart of the braine are as wel seated in the middle and in the hinde-part as they are before: for hetherto scarse their ourth part hath beene demonstrated, their magnitude being answerable & proportionable in respect of their forme to the magnitude of the whole braine, and the swelling prominences thereof: neither is it to be doubted but that the cauities of the braine while the creature is alriue are farre larger then after he is dead, because after death the braine that was streatched and as it were extended with spirites, when those spirites are vanished falleth into it selfe and so the cauities are lessened and contracted. *Hippocrates* *Aristotle.* The magnitude of the ventricles.

Now the braine is on either side long, and where the two sides the right and the left doe regard each other it is plaine and depressed, in other partes it hath sphericall or round productions or prominencies answerable to the hollownes of the bones wherein it is contayned.

The *anterior* or forward prominence filleth the cauity formed by the forehead bone, a part of the spongy bone, the bone of the *sinciput* or side of the head and the wedge-bone; the middle and lower prominence filleth on both sides the cauity formed by the backepart of the wedge-bone, the forepart of the stony-bone and the bone of the temples. The *anterior* prominence.

The posterior

The *posterior* or backward prominency filleth the cauity made by the vpper part of the *Occipitium* and the latter part of the wedge and stony-bones. And to these prominences the cauity of the ventricles is answerable; for from the forward prominences there runneth a notable bosome or hollownes, euen vnto the latter or backward; which *Sinus* or hollownesse is so farre distant from the outside of the braine in the back-part as it is in the forepart.

But when it attaineth vnto the angle or corner which is in the vpper part of the stony-bone, it is reflected to the middle and lower prominence of the braine and after the same manner is excauated or hollowed in that prominence or production as it is in the *anterior* or *posterior* parts.

Mercurialis.

But why is the ventricle thus figured? why did Nature neglect the round figure and reflect it thus into it selfe? *Mercurialis* maketh answere; That as in a pond or Lake wherein water may rage, men do frame out some oblique angles, or corners wherein his direct and impetuous course might be broken: or as it was in that Hauen into which *Aeneas* put in a storme, against the sides whereof *Virgil* saith:

omnis ab alto
Frangitur, in que sinus scindit sese vnda reductos.

The waues are broken from the Mayne,
And in the Creekes are cut in twaine:

So Nature to interrupt the violent motion of the spirits, least they should offend the wals as it were the shores of the ventricle, cut out these Angles or set out these Peeres against which or in which their violence might be broken.

Furthermore the braine, which without the compasse of the ventricles is very thicke (considering the ventricles as they are commonly demonstrated;) if you haue a respect to these two ventricles as we exhibite them is farre thinner then it is in other parts, and like a shell compasseth these two cauities, which truely might be called but one ventricle were it not distinguished by the interposition of that body which is called *Corpus Callosum*; [table 25, fig. 2, m n o] & these only are the ventricles of the brain. Now what those parts are which are commonly called the third & the fourth ventricles it remaineth that we shew vnto you.

What are the 3. and 4. ventricles commonly so called.

The whole braine as also the spinall marrow is diuided into two parts, and is onely ioyned in the middle and lower part by that Callous body we spake of euen now, [Table 25, fig. 2, m n o] which is nothing else but the braine in that part conioyned. For where the right & the left parts were to be ioyned they are bent a little outward, afterward growing white they are reflected to the middest and so vnited. This vnion hath a kinde of conuexity or embowed figure proportioned to the conuexitie of the braine, which also is as long as the Sagittall suture or seame. Some thinke that it is harder then the other parts, but wee thinke it is as soft as the braine it selfe, and is very white like the inward parts or sides of the ventricles. The interior part of this vnion is ordinarily called *Fornix* or the Arch.

The *Corpus Callosum.*

The Arch of the Braine.

The two Trunkes produced from the braine being become round do touch another, and so bend somewhat forward; but againe returne backward toward the hole of the *Occipitium*; and because they are round bodies they make betwixt themselues in their first contaction a a light anguler or cornered cauity vpon which the Basis of the braine beeing vnited doth leane it selfe, so that from the mutuall touch of the bodyes before spoken of that space is formed which they call the third ventricle, which to say truth is without the braine and formed not by any intention of Nature but of necessity, because of the coniunction of these bodies.

The third ventricle.

In the vpper part heereof towards the sides there appeare two long slits or fissures which run almost through the middle circumference of the trunkes of the spinall marrow, and so passe into the ventricles of the braine, and by the way of these fissures the ventricles haue an outlet vnto that they call the third ventricle. And because the foresaide trunkes doe reach as farre as to the Saddle of the wedge-bone where the Tunnell is, therefore it is commonly saide that the *anterior* passage of the third ventricle reacheth vnto that part.

The fourth ventricle.

The fourth ventricle so called, is a *Sinus* or hollownesse betwixt the lower part of the *Cerebellum* and the vpper trunks of the spinall marrow, where the same spinal marrow is caued or hollowed like a writing pen. This *Sinus* or bosome is made of the two trunks proceeding out of the *Cerebellum* for the framing of the spinall marrow, and is lengthened out of the distance of both those propagations of the After-braine. For before they bee vnited with those two other greater trunkes which arise from the braine it selfe, they passe along aboue them a little distant one from the other. So that this cauity like as the other, ariseth

rather

rather vpon necessity of the position of the parts then from any foresight or intention of Nature; because like as the third so also this fourth ventricle is scituated without the braine and the *Cerebellum*.

That hole which is called the latter *foramen* of the third ventricle, which some make to be like vnto the fundament and will haue to enter into the fourth ventricle; is nothing else but a space made by the contaction or mutuall touching of the foure trunkes of the spinall marrow where the trunkes of the *Cerebellum* are bent downeward and adheare or cleaue to the Trunkes arising from the braine. The fundament of the Braine.

Here appeare foure orbicular prominences commonly called the Buttocks and the Testicles of the braine, which they commonly affirme to be within the braine though indeed they are without. And these *Varollius* thinketh to be the true originals of the spinal marrow: and that the buttocks are nothing else but portions of the roots of the spinall marrowe proceeding out of the *Cerebellum*, like as the Testicles are small portions of the roots proceeding from the Braine. The buttocks and Testicles. The true originals of the spinal marrow after *Varollius*

Concerning the vse of the ventricles, the common opinion is, that they are the conceptacles or receptacles of the Animal spirits as the left ventricle of the heart is the place of the vitall spirit. But although we will not deny that there may bee many vses assigned to one and the same part: (and therfore *Galen* in the tenth chapter of his eight book *de vsu partium* was of opinion that the vpper ventricles did serue for the preparation of the spirits & also for the expurgation of superfluities,) yet we are of opiniõ that these ventricles are the receptacles of the phlegmatick humor which is ingendered in the braine, which through the *infundibulum* or Tunnel is conuayed to the phlegmatick glandule and so purged away. For the ventricles haue no where any outlet but onely at the Tunnell: but for the Animall spirits we think that they are disseminated through the whole substance both of the brain & of the After-brain. And this we shew first by the testimony of *Hippocrates*, who when he had deliuered that man consisted of foure humors, and did assigne to euery one their proper place he saith; That the place of the spirits and of the bloud is in the hart, of yellow choller in the Liuer, of blacke in the spleene. And if the place of phlegme be in the braine there must of necessity be a cauity which may containe it; such as is the ventricle in the heart and the bladder of gall in the Liuer: Now beside these two ventricles there is in the braine no cauity at all. The vse of the ventricles. *Galen.* That the ventricles receiue the phlegme. *Hippocrates* his first reasõ.

Secondly, it is proued by the general vse of Glandules which is to sucke vp and consume superfluous humidity. Whereas therefore in these ventricles there are Glandules found in that complication or web of vessels therein disposed; it followeth that phlegme is therein gathered, which distilleth out of that textute or web into the ventricles and there is heaped together; (for they are not able to cõsume so great a quantity) otherwise both the Glandules should be in vaine added by Nature, and their vse and commodity assigned by *Hippocrates* should be idle and of no vse. 2. reason.

Furthermore it is acknowledged by all men that the phlegme doth distill from the braine through the Tunnell vnto the Pallet. Now the beginning of the Tunnell is in the ventricle, neyther is there any passage from any part of the braine vnto the Tunnell vnlesse it be out of the said ventricles. 3. reason.

Fourthly, it is proued by an argument taken from necessity: because this phlegmatick excrement did require great and large cauities. For if there had beene no conuenient place wherein a notable quantity thereof might be stabled or heaped together; wee should haue beene troubled with continuall spitting and spawling (euen as they in whose bladders the vrine is not collected and retayned doe continually auoid their water by drisling or drops) and so our speech and other noble actions interrupted. And hence it is that in sleepe a great quantity of this phelgme being collected, after we awake we auoid it plentifully in a short time. Now this quantity because it could not be contained within the *Dennes* or hollow cauities of the nose behooued to haue some other receptacle in the braine wherein it might be reserued till conuenient time of euacuation. 4. reason. Many instances from our sence.

We do also sensibly perceiue that if a man be desirous to spit and therefore sucke the vpper part of his Pallate, he shall gather great quantity of this phlegmatick excrement into the cauity of his mouth and thence spit it foorth. But if hee againe instantly striue to spit he shall auoid a lesse quantity; and so lesse and lesse till by sucking hee can gather no more spittle. But after a short interim or interposition of time the excrement wil againe fal into his mouth; which is a most euident signe that this matter is in some notable quantity collected

colected or gathered together before it be auoyded as it is in the Vrine & the excremẽts of the belly.

What we conclude.

We conclude therefore that these Cauities of the ventricles do receyue the foresaid excrements, because those Glandulous complications doe enter into them, and out of them onely are the passages by which the moysture is auoided.

Mercurialis his obiections.

Mercurialis opposeth on this manner. How may it be that so thicke, cold and obscure or dull a humor so contrary to the spirits should be collected in that place where the spirits themselues which are pure and subtle bodies are as it were in an Ouen baked & perfected? Moreouer, the causes of an Apoplexie, Epilepsie or Falling sickenesse and the *Incubus* or Night-Mare are by all Physitians acknowledged to be, when as Flegm or Melancholy, or crasse and thicke winde is reteyned in the Ventricles, which stopping them vp either wholy or for the most part, do strangle the spirits therein conteined, which (as *Galen* saith in his third Booke *De Locis affectis*) *Hip.* signifyed in darke and obscure words in the end of the second Section of the sixt booke *Epidemian*, where he writeth, *That the disease called Melancholia hapneth when the humour falleth into the seate of the minde, and the Epilepsie when it falleth into the body of the Brain.*

Hippocrates.

Plato.

Plato also consenteth with *Hippocrates* in *Timæo* where he writeth, that the Falling sickenesse happeneth when Flegme mingled with Melancholy entreth into the diuine cauities of the braine. *Varolius* maketh answere on this manner. For the Causes of the Apoplexie, Epilepsie and *Incubus*, although I sometimes read in *Hippocrates* as in the Ninth Text of his Booke *De Glandulis*, that the Apoplexy is occasioned by the *Corrosion* of the braine, and in the nineteenth and twentith Texts of his Booke *De Flatibus*, that the Epilepsy is caused when the blood is disquieted and defiled in all the veines, as also vvhen the same veines are obstructed. And that I reade in *Galen* in the seauenth Chapter of his third booke *De Locis Affectis*, that hee doubted whether the Epilepsy were made by an obstruction of the ventricles of the Braine, or of the Spinall Marrow, and therefore that I willingly graunt that these diseases may haue these causes: yet I conceiue that it wil not abhorre from reason to thinke, that the Ventricles (though the Animall spirits bee conteyned in them) are sometimes so fulfilled with a viscid humour or thicke wind, that the first roote of the Spinall Marrow may be compressed by the aboundance thereof, so that the transportation and affluence of the spirits thereunto may bee interrupted and intercepted, and consequently the whole bodye depriued of sense and motion. Like as the bladder in the suppression of the Vrine being beyond measure distended lying hard vpon the guts, the auoyding of the excrements is hindred.

Varolius his answere to *Mercurialis.*

The causes of the Apoplexie *Hippocrates. Galen.*

Do not contradict *Varolius* opinion.

Another satisfaction.

And if this answere will not please the pallate, I will say with *Galen* in the place before quoted, that the Epilepsy and such like diseases do proceede by the obstructing or immuring of the Spitits, which happeneth when the beginning of the Spinall Marrowe is choaked by an vnnaturall confluence of humours vnto it. And this opinion is confirmed by the Dissection of the heads of such men as dye Apoplecticall, in the Ventricles of whose brains there is not found any greater quantity of excrements then is commonly found in other men.

This opinion. Confirmed by Dissection

Furthermore, they Obiect that in the Epilepsy, the Apoplexy and the *Incubus* the Animal spirits residing in the Ventricles of the Braine are strangled or their outgate hindred. *Varolius* answeres that these diseases happen not from any humour or winde atteyning any way vnto the Ventricles, but by reason of a great quantity and notable thickenesse, or sudden eruption. Wherefore euen as the excrements descending by the pallate and the nose do not offend the taste or the smell if they passe through those Organs moderately and according to Nature, but do either hinder or vtterly intercept their operations if they exceede the measure and proportion of Nature in quantity or in quality: so we thinke we are to conceiue of the excrements accruing vnto the ventricles of the brain or receding there-from.

Another Obiection. Answered.

That the spirits are in the substance of the Braine. *Galen.*

Now that the Spirits are dispersed through the substance of the braine, we prooue by the testimony of *Galen* in the 13. chapter of his eight booke *de vsu partium* where hee sayth, That the Animal spirite is in great quantity conteyned in the body of the braine, as also of the *Cerebellum* to which he attributeth the Original or beginning of the nerues of the whole body, and therefore he inferreth that it is necessary it should bee filled vvith the aboundance of spirits.

If therefore the *Cerebellum* which hath in it no cauity at all doth yet conteyn in his sub-

ſubſtance plenty of ſpirits which flow from it to ſo many nerues remooued by ſo great diſtances therefrom, why may we not beleeue that after the ſame maner yea a great deale rather the ſpirites may bee conuayed without manifeſt cauities out of the braine to a fewer nerues and thoſe not far diſtant from it but euen at hand? Seeing therefore that the Animall ſpirits can ebbe and flow without any ſenſible paſſage; why may wee not aſcribe that vnto the ſubſtance of the braine which others haue aſcribed vnto the ventricles although they haue not duely obſerued them? The concluſion.

Of the web or complication called Plexus Choroides.

Finally, the complication or web of veſſels which they call *Choroides* or the Net which is in the ventricles of the braine; [table 25. fig. 2. ik] ſeemeth to be altogether glandulous or kernelly, ſo that both in ſubſtance and colour it may be likened to the Pine-glandule wee ſpake of in the 12. Chapter; yet if you handle it nicely and mark it diligently you ſhall find that it is nothing elſe but a heape of broade and long membranes growing out of the *pia mater* of the braine, at the one ſide whereof through out their whole length hangeth a little thicke veſſell full of excrementitious moyſture, through which exceeding ſmall veſſels are deriued: & if we may compare little things with great, it is like a gut tyed vnto the meſentery, yet for the proportion there are in it more glandules then in the meſentery of the lower belly. And this manifeſtly appeareth in their heads whoſe braines are very moyſt & therefore ſayeth *Varolius*, it were more agreeable to their nature to call them Glandulous then *Net-like complications*. Of the *Plexus Choroides*. What it is.

And if any man doubt whether the ſubſtance of them be ſuch as we haue ſaide, wee remit him vnto his own ocular inſpection, ther being no argument of greater valliditie. For ſayth *Varolius* in all carkaſſes which we haue opened, we haue found theſe glandules full of ſuch a muddy moyſture as we finde in the reſt of the Glandules of the body. Albeit *Archangelus* doe thinke that ſuch excrements are onely found in diſeaſed braines. That it is glandulous.

The vſe of this glandulous complication ſeemeth to be; that like other glandules it might ſucke vp the ſuperfluous moyſture of the brain, for that is the office of the glandules in the whole body: yea *Hippocrates* himſelfe in the ſecond Text of his Booke *de glandulis*, proueth by an induction of the particular glandules of the whole body, that when the body aboundeth with ſuperfluous humidity it is thereof exonerated and diſcharged by the glandules; yea he proceedeth ſo far as to ſay that the whole ſubſtance of the braine is glandulous. The vſe of this complication.

Now concerning the reſt of the parts of the braine of which in this new demonſtration or diſſection wee haue made no mention, you muſt conceiue of them as their hiſtories are deſcribed before.

But if a man bee deſirous in this kinde of Section to demonſtrate or exhibite to the ſpectators all the parts, then muſt he proceede in this order. After he hath taken away all the bones of the head by ſawing them through the length aboue and beneath, before and behinde; he muſt firſt make demonſtration of the *Sinus* or veſſels of the *dura meninx*. Afterward turne the head and at the Baſis of the braine ſeparate the Meninx from the ſpinall marrow, yet muſt he leaue portions of the Meninx about the nerues that they be not broken, for then you cannot follow them to their originall. How this ſection muſt be adminiſtred.

Vnder the membrane which inueſteth the ſpinall marrow there appeareth a texture or web of veſſels diuerſly croſsing one another, which they commonly call *Rete-mirabile*, the Wonderfull Net; then the flegmatick glãdule commeth in ſight which is almoſt ſquare, & the neck of the Tunnel which are ſcituated without the thick Meninx. From hence our eye paſſeth vnto the membrane of the ſpinall marrow and the marrow it ſelfe; which being lifted vp we behold the buttockes, the teſticles, the paſſage into the fourth ventricle and the fourth ventricle it ſelfe, all which are without the braine. Wee ſee alſo the After-braine, the proceſſes thereof, the auditory nerue, the mouing nerues of the eye together with the opticks, the organs of ſmelling, the two ventricles of the braine together with their paſſage into the Tunnell, as alſo the Callous body, the Arch, the Complication called *Choroides*, and the Pine-glandule. And thus much concerning *Varolius* his newe way of diſſecting the head, which we haue added as an accompliſhment to this Booke of the braine, becauſe indeed after this manner all the parts thereof are beſt ſhowne and to beſt purpoſe. Now we proceed to the Controuerſies. How the particular parts of the braine ariſe.

¶ A Dilucidation or Expoſition of the Controuerſies concerning the Braine and the Parts thereof.

QVEST. I. *Whether the Braine be the ſeate of the Principall Faculties.*

A diuiſion of the Animal Faculties.

The common ſenſe.

THE Animall Faculties are by the Phyſitians diſtinguiſhed into Faculties of *Senſe*, Faculties of *Motion* and *Principall* Faculties. The ſenſitiue Faculty is double, one Externall whoſe obiect is ſingular or one; the other Internall vvhoſe obiect is common or manifold: this Internall Facultie the Philoſophers call the Primary or *Common ſenſe*; and this is it which alone maketh the differences of *Images* as wee call them or Abſtracted Notions. She ſitteth in the ſubſtance of the Braine as in a throne of Maieſty beholding the Formes or Ideas of all things vnder her feet. This is ſhee that diſcerneth betwixt ſweete and bitter, and diſtinguiſheth white for ſweete. This common ſenſe *Ariſtotle* compareth to the center of a circle, becauſe the ſhapes and formes receiued by the outward ſenſes are referred or brought heereunto as vnto their Iudge and Cenſor.

The Imagination.

After this inward ſenſitiue Faculty do follow the principall Faculties; and firſt of all the Imagination which conceyueth, apprehendeth and retaineth the ſame Images or repreſentations which the common ſenſe receiued; but now more pure and free from all contagion of the matter, ſo that thogh thoſe things that moue the ſenſes be taken away or other wiſe doe vaniſh, yet their footſteps and expreſſe Characters might remaine with vs. And this conception or apprehenſion we call *Phanſie*. By this *Phanſie* that ſupreme & ſoueraign *Intellectual* power of the Soule is ſtirred vp and awaked to the contemplation of the Ideas or Notions of vniuerſall things.

The Intelligence.

The memory.

Finally, all theſe are receyued by the Memory, which as a faithfull Recorder or Maiſter of the Rolles doth preſerue, ſtore vp and diſpoſe in due order all the forenamed Notions or abſtracted formes. And theſe are the Principal Faculties according to the Philoſophers and the Phyſitians, concerning which we haue three things to enquire.

3. Queſtions.

The firſt, whether the Braine be the ſeate of them all. Secondly, whether in the braine theſe diuers Faculties haue diuers Manſions. And laſtly, whether theſe principall Faculties do reſult or ariſe out of the temperament or from the conformation of the Brain, and whither they be Similer or Organicall.

Diuers opinions.

Concerning the ſeate of the reaſonable Soule the opinions of the Philoſophers and Phyſitians are very different. *Herophilus* placeth it about the baſis of the braine. *Xenocrates* in the top of the head. *Eraſiſtratus* in the Membranes of the braine. *Empedocles*, the *Epicures* and the *Egyptians* in the Cheſt, *Moſchion* in the whole bodye. *Heraclitus* in the outward motion. *Herodotus* in the eares. *Blemor* the Arabian in the eyes, becauſe the eyes are the diſcouerers of the minde, and ſo fitted and compoſed to all the affections and affects of the ſame, that they ſeeme to be another Soule, for when we kiſſe the eye wee thinke wee touch the ſoule it ſelfe.

Herophylus.
Xenocrates.
Eraſiſtratus.
Empedocles.
Moſchion.
Blemor.

Strato Phyſicus.

Strato the Naturaliſt thought the ſoule inhabited in the eye-browes, becauſe they are the ſeate of *pride* and *Diſdaine*, and therefore the Poets were woont to call pride the Eye-brow, and we commonly ſay of an inſolent man, that we ſee pride ſitting vpon his browe.

Prouerbe-

More-

Moreouer from the haires of the browes the Phisiognomers gather signes of the disposition of the minde. For if they bee straight it is a signe of a soft and flexible disposition; if they be inflected neare the nose they are a signe of a scurrulous Buffon; if they bee inflected neare the temples they argue a scoffing Parasite; if they bend all downewards they are an argument of an enuious inclination. The *Perepatetickes* and *Stoicks* doe all of them place the faculties of sence and vnderstanding in the heart, because say they that that is the principle or beginning of motion is also the originall of sence: But the heart is the principle of all motion, because it is the hottest of all the bowels and a liuing fountaine of Naturall heate. Moreouer, in passions of the minde, as Agonies, Feares, Faintings and such like, the spirites and the heate returne vnto the heart as vnto their Prince. And for this they bring the authority of diuine *Hippocrates* in his golden Booke of the heart, where hee sayth, *The Soule of a man is seated in the left ventricle of the heart, & from thence commandeth the rest of the faculties of the Soule, and it is nourished neither with meate nor drinke from the belly, but with a bright and pure substance segregated from the bloud.*

Strato his Phisiognomy of the eie-browes.

The opinion of the *Peripateticks.*

Hip. authority.

We with *Hippocrates*, *Plato*, *Galen* and all Physitions, do determine that. The braine is the seate of all the Animall faculties, for if the braine be offended, wounded, refrigerated, inflamed, compressed, or after any other manner affected, as it is in a phrensie, *Melencholia*, *Charos*, *Chatoche*, or *Epilepsie* wee may discerne a manifest impeachment of all the Animall functions, which if wee desire to cure, wee apply our remedies not to the heart but to the braine. But if the heart were the seat of the principal faculties then in all affections or notable distemper thereof, all the functions should be interrupted, because the action is from the Temperament. But in a Hecticke Feuer in which there is an vtter alienation of the Temperament, the voluntary and principall faculties remaine sound and vntainted. When the heart is violently moued as in Palpitation, neither is the voluntary motion of the parts depraued nor reason it selfe. Who will deny that the vitall faculty is oppugned by a pestelent aire, the byting of a venomous creature, or by taking of poyson? but al those that are so affected do yet enioy their sence and reason. If (saith *Galen* in his 2. booke *de placitis Hippocratis & Plat.*) you beare the heart and presse it, you shall perceiue that the creature will not be hindred in his voyce, his breathing or any other voluntary action.

The opinion of the Physitions.

That the braine is the seat of the Animal faculties.

And whereas *Hippocrates* placeth the Soule in the heart, happly hee speaketh after the manner of the common people as hee vseth oftentimes to doe; now the vulgar imagined that the Soule was in the heart. So he calleth the *Diaphragma* or Midriffe φρένας the Minde, when as notwithstanding those Vmbles haue no power whereby the creature doth vnderstand any thing, as he teacheth in his Booke *de morbo Sacro* or the Falling sicknes.

Hip. expounded.

Or we say that by the Soule in that place hee vnderstandeth the chiefe instrument of the Soule, to wit, the *Heate*. So in his first booke *de diæta* he commonly vseth the word *Soule* for *Heat*, as when he sayth *That the Soule of man is encreased euen vnto his death.* And againe in the same Booke *The Soule creepeth into a man being mingled of fire and water.* Where by the Soule I vnderstand the heat throughly dewed or moystned with the in-bred and primigenie moysture and the spirits. And that in his Booke *de Corde* by the Soule hee vnderstandeth the heate, those words do declare, where he sayth, That the Soule is nourished by the most pure and defæcated bloud. Now in his first booke *de Diæta*, hee writeth that the Soule cannot be altered neither by meats nor drinks. VVhich place because it is as bright as the Sun in his strength and worthy to be written in golden Letters, wee will here transcribe. *The causes of all those things whereby the Soule is altered, are to be referred to the nature of the passages through which it penetrateth. For as the vesselles are affected wherein to it retyreth and to which it falleth and with which it is mixed, such is their condition; and therefore wee cannot alter them by dyet, for it is impossible to alter or change the inuisible Nature.*

Hip. often vseth the word Soule for heate.

An elegant place of *Hip.* concerning the immortality of the soule.

In his Booke *de morbo sacro*, he affirmeth, that in the heart there is no wisedome or intelligence, all sayth he is in the power of the Braine. From the braine we vnderstand, doote and grow mad, as it is hotter, or dryer, or colder.

Galen in his third Booke *de Placitis*, conuinceth by many arguments that the braine is the seate of all the Animall faculties. And in the fourth Chapter of his third booke *de locis affectis* according to the opinion of the vulgar hee accounteth that man foolish that wanteth braines. For the further confirmation of this opinion we wil adde an elegant argument out of *Philo*.

Galen.

VVheresoeuer the Kings Guard is there is the person of the King whome they doe guarde; but the guarde of the Soule, that is, all the organs and instruments of the Sences

Philo his argument.

are

are placed in the head as it were in a Citadell or Sconce; there therefore doth the soule keepe her Court, there is her residence of Estate. If therefore the sensatiue faculty be placed in the braine, the intellectuall must be there also, because as saith the Philosopher the office of the Intellectuall faculty is to behold and contemplate the Phantasmes or Images which by the senses are represented vnto it. We resolue and conclude thereforethat the braine is the seate of all the Animall faculties as well Sensatiue as Principall.

QVEST.II. *Whether the Principall faculties haue distinct places in the Braine.*

What a principall faculty is.

SEeing therefore the Principall faculties are there: Imagination, Reason and Memory; and that their seate or habitation is resolued to be the brain: let vs now enquire whether they haue distinct & particular mansions prouided for euery one of them. *Galen* in his booke *de Arte parua* defineth principall functions to be such as yssue onely from a principle: and in the second *de locis affectis* he addeth. Which are accomplished by no other part as by an Orgā and Instrument. And yet more plainely in the 7. book *de placitis Hip. & Plat.* Which are only in the braine and thence doe proceed, not receiuing their operation from any other Organs of sense or motion.

The opinion of the *Arabians* that they haue distinct seates.

The whole Schoole of the *Arabians* hath imagined certaine mansions in the braine, and assigneth to euery particular faculty a particular seate; and this is *Auicen* his opinion, *Fen.1 primi, doctrina 6, Cap,5.* As also *Auerrhoes* in his Canticles, his book *de memoria et reminiscentia and in Colliget.*

They place therefore the Phantasie in the forward ventricles, Reason in the middle, and Memory in the hinder ventricle: and this opinion may be established by many arguments

The first argument.

on this manner. Almost all the sences are placed in the forepart of the head, wherefore because the Imagination is to receiue and apprehend the species and representations of sensible things it must be placed in the fore-part.

By the Imagination the Intellectuall power is stirred vp and abstracteth the Images of things from those Imaginations, and therefore it must be scituated next vnto the Phansie; and because that is the most immediate Instrument of the reasonable Soule, it was fitte it should reside in the safest and most honourable place which is the middest, that is, the third ventricle.

This Intellectuall faculty commendeth those abstracted formes of things vnto the Memory, which it layeth vp as it were in a Treasury, and therefore the seate of the Memory must be in the hindmost and dryest part of the Braine which is the fourth ventricle.

The second argument.

Againe, the Imagination being a conception of Images, and accomplished only by reception and simple apprehension, requireth the softer substance of the braine wherein such sensation might be made. The Memory desireth the harder substance of the braine that it might be able the longer to retaine those Notions which it storeth vp. Ratiotination is best pleased with a substance of a middle nature betwixt the softer and the harder. Now the forepart of the braine is the softer, the hindpart the harder, and the middest of a middle constitution; and therefore the Imagination is in the forward ventricles, Ratiotination in the middle, and Memory in the hindmost.

The third argument.

Thirdly, that these principall faculties are discluded or separated by their mansions these things doe demonstrate; because if one of them be offended yea or perish vtterly, yet the other may remaine vntainted or vnaffected. For it oftentimes happens that the Imagination is vitiated and yet the Intellectuall faculty not at all depraued. For the confirmation of

Histories.

this we haue many elegant Histories in *Galen*, as in the third chapter of his booke *de Symtomatum differentijs* and the second chapter of his fourth booke *de locis affectis*. *Theophylus* being otherwise able to discourse very well, hadde yet an Imagination that there were Fidlers in the corner of his Chamber and continually cryed to haue them thrust out. Another being Phreniticall lockt the doores of his Chamber to him and carried all the vessels to the Windowes, where giuing euery vessell his proper name he asked those that passed by, whether they would command him to cast them out. *Thucydides* reporteth that when the plague was so hot throughout all *Græcia* and *Peleponnesus* that many did so vtterly forget what they had knowne before, that they did not remember their Parents or familiar friends. In these men therefore onely the Memory was offended; in *Theophilus* onely the Imagination, and in him that was Phreniticall onely the Intellectuall faculty or vnderstanding.

More-

Moreouer, vnlesse the principall faculties had seuerall seats, why were there diuers ventricles or cauities made in the braine? And why is one of them more noble then another, vnlesse it be because it is the seat of a more noble faculty. The 4. argument.

VVe will also adde an argument taken from the secrets of Phisiognomy. They that haue a large Nowle or backpart of the head are sayde to haue happy memories; but when the forepart and the forehead doth set outward, the Imagination is the stronger. On the contrary, those that want both these processes are euen by the common people esteemed fooliſh Idiots: and this is the Phylosophy of the Arabians concerning the seates of the faculties. The 5. argument,

Let vs now come vnto the Greek Family. *Galen* the Prince of this Sect conceiueth that the principall faculties are all establiſhed in one place, occupied about the same Images or Notions, do vse the same instrument, to wit, the brain; but their manner of working saith he is diuers. The opinion of *Galen* against the Arabians.

In the eight booke *de vsu partium*, vnder the name ἡγεμονικὸν, hee comprehendeth the three principall faculties and teacheth that they reside in the whole braine; and in the same booke he sayeth that the principall faculties haue their resience or residence not onely in the ventricles but also in the whole body of the braine.

For to what other purpose should the substance of the braine haue beene made so large and ample. In his third Booke *de Placitis Hippocratis & Platonis*, hee sayeth, that if one of the ventricles be offended, all the principall faculties are therewith affected. And this is confirmed by daily experience and the euent of things. For in the *Epilepsie* or falling Sickneſse there is an interception of the minde and al the sences, and yet this obstruction doth not occupy all the ventricles. The Phrensie is an inflamation of the braine and his membranes. Now we obserue in this disease that sometimes Reason alone is peruerted, sometimes the Imaginatiõ, somtimes the Memory: yet who will euer say that in the phrẽsie one ventricle onely is inflamed? In that kinde of *melancholia* which proceedeth immediately from the braine and is a cold and dry distemper of the whole substance thereof, yet sometimes I say in that disease onely one faculty is depraued, sometimes the Reason sometimes the Imagination. VVherefore the principall faculties are diffused through all the ventricles and through the whole marrow of the braine. And though they are distinct one from the other, yet doe they exist together in the same particle of the subiect; for one and the same Soule performeth the offices of these different faculties by the vse of diuers meanes and a difference of Tempers. So in one and the same particle of a bone there are diuers faculties included, a drawing, a retayning, an assimulating and an expelling faculty. One of which, though it be affected when as oftentimes the rest are not taynted, yet a Physition will not therefore say that they are discluded in their seates and subiects. As therefore in the stomacke diuers faculties are offended by diuers distempers, the retayning faculty especially by a moyst distemper & the assimulating by a dry, yet are not these faculties separated in diuers partes of the stomacke: so with *Galen* wee thinke and determine concerning the principall faculties, that the whole substance of the braine is the seat of them all promiscuously disposed therein, which substance if it bee somewhat dry a man shall haue a faster Memory, if somewhat moyst his Imagination or fantasie will be the better.

Authorities.

Examples.

Inference vpon the examples.

Comparison

Obiection.

They that follow the opinion of the *Arabians* doe obiect vnto vs that *Galen* is on their side, for in his Booke *de oculis*, he placeth the Fantasie in the forepart of the brain, Reason in the middest, and Memory in the hinderpart. VVe answere that we thinke that Booke is not *Galens* but a bastard falsly fathered vpon him. They adde further that when the imagination is offended *Galen* applyed his remedies to the *sincipat* and forepart of the head; because there is the seate of the Fantasie. But they doe not consider that *Galen* doth the very same almost in all diseases of the head, as the *Caros*, the *Apoplexie*, the *Phrensie* & *Melancholia* in the twelfth of his Method and in the second Booke *de Medicamentis secundum locos*, and that not by the reason of the diuersity of seats, but that the force of the medicine might sooner penetrate into the inner parts of the brayne. For that which is applied to the forepart of the head pierceth deeper and sooner because of the thinnes of the skul in that place and the openneſse of the Coronall suture.

Answere.

That place of *Galen* in the second Chapter of his fourth Booke *de locis affectis* seemeth to make more for their purpose, where he writeth. *If when the forepart of the braine is offended the third ventricle be affected by consent, then will the vnderstanding be depraued.* Hee seemeth therfore to say that the vnderstanding is not vitiated vnlesse the third ventricle be offended. Againe, in the 27. Commentary vpon the first Section *Parrhet: If a humour bee fastned and stablished in any part of the braine those symptomes will follow which are agreeable*

A 3 obiection made.

Places of *Gal.* for the Arabians.

as well to the nature of the part as to the humor, as for example. If the humor bee eſtabliſhed in the forepart it will breede a Phrenſie in which the Imagination is offended. Hee addeth further. *When the matter is tranſported in the Brayne out of one part into another, the diſeaſe will continew to be of the ſame kinde, but the ſymptoms will alter according to the part affected, as ſometimes the Imagination will be offended, ſometimes the Reaſon.* We anſwere, that we thinke all the principall faculties are contained in the whole braine, but we do not deny but that one faculty is more manifeſt in one ventricle then it is in another, as the ſpirits are in this cauity more thin, perfect and better laboured then they are in another.

Anſwere to thoſe places.

Finally they obiect, if the principall faculties be not ſeuered in their places and habitations, why is one ventricle more noble then another? For *Galen* in the 5. Chapter of his third booke *de locis affectis*, and in the 8. *de vſu partium* preferreth the hindmoſt ventricle to both the reſt and the middle to the foremoſt. And againe in the ſixt chapter of his ſeauenth booke *de placitis Hip. et Platonis*; he writeth that the wounds of the fore ventricles are dangerous, of the middle more dangerous and of the hindmoſt moſt dangerous of al, which ſeemeth not to happen by reaſon of the ſtructure, temperament or ſubſtance of the braine, becauſe all theſe are in all places of the braine alike, but by reaſon of the faculties contained in the ventricles.

Obiection.

Some anſwere that the third and fourth ventricles are more noble then the foreward, not becauſe there reſideth in theſe more noble faculties, but becauſe in them the Animall ſpirit attaineth a further perfection; ſo that by how much the Liuer is more noble then the ſtomacke, the heart then the Lungs and the left ventricle of the heart more excellent then the right, by ſo much and for the ſame reſpects the backward ventricles of the braine are more noble then the foreward.

Anſwere.

We conclude therefore with *Galen*: That all the principall faculties doe promiſcuouſly inhabite in the ſame part of the Braine together, that they vſe the like corporeall Inſtrument, that is, the ſubſtance of the braine, yet they worke after a diuerſe manner according to the variety of the Temperament and the *Medium*.

The concluſion of the queſtion.

QVEST. III. *Whether the principall faculties doe depend vpon the Temperament of the braine or vpon the Confirmation, that is, whether they be ſimilar or organicall actions.*

IT is a moſt obſcure quæſtion whether the Braine do vſe reaſon and apprehend phantaſmes becauſe it is of ſuch a temper, or becauſe of the admirable ſtructure it hath. Some haue conceiued that theſe faculties are performed onely by the Conformation, which their opinion they confirme by authorities and by argumenis. *Galen* writeth in his 7. Book *de placitis*, that the cauſe of wiſedome in man is the variety of the ſtructure of the Braine and the magnitude thereof. The figure of the head according to *Hippocrates* and *Galen* if it bee naturall, that is, ſphericall or round, ſomewhat long, bunching ſomewhat out before and behind and depreſſed or flatted on the ſides, is a ſigne of a wiſe man; and contrariwiſe a ſharpe and Turbinated head like a ſugar loafe, which they call φοξὸν ſuch as was *Thyrſites* head in *Homer*, is an argument of a dull or ſtollid foole. Againe, all the principall faculties periſh when the conformation or ſtructure is vitiated although the Temperament be not yet vitiated, as in the Apoplexy, the Epilepſie and in wounds of the head when the ventricles of the braine are eyther ſtuffed or compreſſed. For in the cracking of the Scull, how can the temperament of the braine in a moment be altered, or elſe in the oppletion or filling of the ventricles by any humor? It appeareth therefore that the principall functions are performed only by the ſtructure and conformation onely of the brain, and that conformation being vitiated they are preſently intercepted.

That the faculties proceede from the conformation.

Authorities. The 1. reaſon.

The ſecond.

On the contrary there are others who thinke that the next and immediate cauſe of theſe principall faculties is the temper of the marrowy ſubſtance and of the ſpirits of the braine. Let vs heere *Hippocrates*, *Apollos* eldeſt ſonne and the pillar of the family of Phyſitians in his firſt booke *de diæta* teaching the ſame thing in plaine words. *When in the body the dryeſt part that is the fier, and the moiſteſt part that is the water, are æqually tempred, then is a wiſe man borne.*

The contrary opinion.

Authorities. *Hippocrates.*

And theſe are the words of the diuine *Plato* in *Theateto*. *The ſoule is not well diſpoſed in a denſe or muddy brain, neyther yet in a ſoft or hard brain; for ſoftnes makes men of quicke apprehēſiō but then they are forgetful withal, hardnes makes better memories but dulnes of capacity*

Plato.

and

and denſity contayneth duskiſh and obſcure phantaſmes or images. *Galen* in his 8. booke *de vſu partium* ſayth, *It is better to thinke that the vnderſtanding followeth not the variety of compoſition, but a laudable Temper of that body wherewith we vnderſtand: for the perfection of the vnderſtanding is not ſo much to bee attributed to the quantity of the ſpirits as to the quality.* The ſame *Galen* in his Booke *de Arte parua*, referreth the cauſes of wit or capacity to the thicke or thin ſubſtance of the braine. *Galen.*

This wit hee calleth ἀγχίνοιαν, that is, *a working capacity*, which is defined ἐυστοχία, that is, a promptitude or readines of Inuenting and coniecturing. In the ſame Booke ἐυμάθεια, that is, a facility of learning ſheweth a ſoft and moyſt ſubſtance of the brain, and δυσμάθεια, that is a ineptitude to learne, a drie and a hard braine. Thoſe that are light witted and inconſtant in their opinions are for the moſt part of a hot braine, becauſe heate is full of motion. But thoſe that are obſtinate are of a cold braine becauſe cold is ſluggiſh, to which if you adde drought then will ſuch men become ſtubborne and refractary; and hence it is for the moſt part that the Authours and fautors or defenders of Schiſmes and Sects are Melancholy. *Galen* in his book intituled *That the maners of the mind follow the temperature of the body*, calleth the Soule *a conſent of qualites*, & doth not diſtinguiſh it from the temperament.

In his Commentary vpon the 6. Booke *Epidemion* and vpon the ſixt Aphoriſme of the ſecond Section, as alſo in the 6. Chapter of his Booke *de locis affectis*, he ſtyleth the Temperament of the braine *the Minde*. For ſo he expoundeth that Aphoriſme of *Hippocrates*, Melancholy men become Epilepticall and Epileptical men Melancholy; as the humour aſcendeth into this or that part ſo is there a tranſmutation made of theſe diſeaſes. For if the humour be transfuſed into the body and ventricles of the braine then they become Epileptical, if into the minde they become Melancholicall; where-by *Mind* he vnderſtandeth the Temperament. For the diſeaſe called *Melancholy* is a cold & dry diſtemper of the brain. But when *Galen* called the Soule a Temper, he doeth not conceiue that that Temper is the forme of a reaſonable man, but the *forma medica*, becauſe that onely falleth into the Phyſitions conſideration. *Galen* calleth the Soule a temper. How & why.

For that which can neither bee preſerued when it is preſent nor reſtored when it is abſent, that doth not at all belong vnto the Phyſition: but the intellectuall Soule can neither bee preſerued being preſent nor reſtored being abſent; onely the Temperament may bee mantained when we haue it, or reſtored when it is loſt. The Temperament therefore only is the Phyſicall forme of a man, becauſe the Phyſition conſidereth a mans body not as it is Natural conſiſting of Matter and Forme, but as it is ſubiect to ſickneſſe, and againe liable to Phyſicke. And from hence ſome men doe imagine that it is ſufficiently prooued that the principall faculties of the Soule are not excerciſed by the ſtructure or conformation but by the Temper of the braine.

Our opinion concerning this queſtion is, that the efficient cauſe of all the functions is neither the Temper alone, nor only the wonderful ſtructure of the braine; but the intellectuall Soule which notwithſtanding admitteth both theſe cauſes: one Organicall which is the amplitude or largeneſſe of the braine and of the ventricles and the plenty of the ſpirits: the other Similar which is the Temper of the marrowy ſubſtance and of the ſpirites. From hence wee gather that *Ratitionation*, that is, the vſe of Reaſon is neither abſolutely an Organicall action becauſe it is impaired in thoſe that are Melancholicall and Phreniticall, when the ſtructure of the braine is not at all violated; neither yet purely Similar, becauſe the brain is offended when his ventricles are cõpreſſed or ſtuffed vp, all be the Temperament be not offended. What we reſolue of.

Furthermore this *Ratiotiation* is neither inchoated nor perfected by the Temperament alone, neither yet performed by any particle of the braine; but is an action mixed or compounded of an organicall and Similar, ſuch as is the action of the heart & the ſtomack. For the heart indeed is moued and hath his pulſation from an ingenite faculty and proper Temper of his owne: But it could neither haue been contracted nor diſtended vnleſſe it had beene excauated or hollowed into ventricles.

QVEST. IIII. *Of the vſe of the Braine against Ariſtotle.*

IF euer that great interpreter and meſſenger of Nature *Ariſtotle* the Prince of the *Peripateticks* doe leſſe ſufficiently acquite himſelfe it is in the matter of Anatomy, & more eſpecially in that he hath written concerning the vſe of the brain in the ſeuenth Chapter of his ſecond Booke *de part. Animal.* where he cannot be redeemed from palpable abſurdity. The braine ſayth he was onely made to refrigerate The vſe of the braine after *Ariſtotle.*

the heart. First, because it is without blood and without veines; and againe because a mans braine is of all other creatures the largest for that his heart is the hotteſt. This opinion of *Aristotle*, *Galen* in his 8. booke *de vsu partium* confuteth by theſe arguments. First, seeing the braine is actually more hot then the moſt soultery ayre in Summer, how shall it refrigerate or coole the hart? Shall it not rather be contempered by the inspiration of ayre which it draweth in and as it were swalloweth from a full streame? If the *Peripateticks* shal say that the externall ayre is not sufficient to refrigerate the heart but that there is also required an inward bowell to assist it: I answere, that the braine is farre remoued from the heart and walled in on enery side with the bones of the Scull. But surely if Nature had intended it for that vse, she would eyther haue placed it in the Cheſt or at leaſt not set so long a necke betweene them. The heele saith *Galen* hath more power to coole the heart then the braine: for when they are refrigerated or wet, the cold is presently communicated to the whole body, which hapneth not when men take cold on their heads. Beside, the braine is rather heated by the heart then the heart cooled by the braine, because from the heart and the vmbles about it, there continually arise very hot vapours, which beeing naturally light do ascend vpward. Adde heereto this strong Argument which vtterly subuerteth the opinion of *Aristotle* and the *Peripateticks*. If the braine had beene only made to coole the heart, what need had there bin of so admirable a structure? what vse is there of the 4. ventricles, the Chambered or Arched body, of the webs and textures of the Arteries, of the pyne glandule, of the Tunnell, of the Testicles and Buttocks, of the spinal marrow and of the manifold propagations of the sinewes?

Aristotle confuted.

A very strong Argument.

Finally, if this were true that *Aristotle* affirmeth, then should the Lyon which is the hotteſt of all creatures (witneſse his continuall disposition to the Ague) haue had a larger braine then a man, and men because they are hotter should haue larger braines then woemen; which things because they abhorre from reason and sense, wee doubt not to affirme that the brain was created for more noble and diuine imployments then to refrigerate the heart. The body therefore of the braine was built for the performance of the Animall, Sensatiue, Motiue and Principall functions, and it is hollowed into so many ventricles & furnished with so many textures and complications of vessels; for the auoyding of his excrements, for the preparation and perfection of the Animall spirits; besides, the Nerues serue as Organs to lead out the same Animall spirit together with the faculties of motion and sense vnto the sences and the whole body. *Auerrhoes* (*Aristotles* Ape and where occasion is giuen a bitter detractor from Physitions) endeauoreth to excuse *Aristotle* and saith, That the braine doth therefore refrigerate the heart because it tempers the extreame heat of the vitall spirits. But let vs grant that the braine tempers some spirits, yet it will hardly temper the spirits of the heart & of the large Arteries, if it at all temper those spirits which are contained in the substance and membranes of the brain; which spirits so tempered seeing they do not returne vnto the heart, how shal they temper the heat of the heart? *Alexander Benedictus* in the 20. Chapter of his fourth booke seemeth to follow the opinion of *Auerrhoes*. *Albertus Magnus* a man better stored with learning then honesty, although hee be a *Peripatetick*, yet in this point he falleth from his Maister *Aristotle*, and saith in his 12 booke *de Animal.* that the braine by his frigidity doth no more temper the heat of the hart then the siccity or drineſse of the heart doth temper the moysture of the braine.

The true vse of the braine.

What *Auerrhoes* opinion is.

But confuted.

Whether the braine be the originall of the sinewes?
Whether the Nerues be continued with the veines and Arteries?
Whether the Nerues be the Organs of sense and motion?
Whether the Nerues of motion differ from the Nerues of sense?
Why the sense may perish, the motion being not hindered, or on the contrary?
Whether the faculty alone or a spirit therewith doe passe by the Nerues?
By which part of the Nerue the inner or the vtter, the spirit is deriued.

All theſe questions and difficulties with their resolutions you must seeke for in the third part of our booke of the vessels. The rest of the questions we now prosecute.

Where theſe questions are disputed.

QVEST.

QVEST. V. *Whence it is, that when the right side of the Head or Brayne is wounded or enflamed, a Convulsion falleth into the opposite partes.*

WEe haue a double Probleme heere to discusse. The first, how it commeth to passe, that when the right side of the Head is wounded or enflamed, it oftentimes falleth out that the lefte parts of the bodie suffer Convulsion. The second, why one part of the Braine beeing smitten or obstructed, it sometimes happeneth that the contrary side of the body is resolued or becommeth Paralyticall.

Both these questions haue in them many difficulties. For the affections or diseases almost of all the parts are communicated κατ' ἰξιν, that is, *by rectitude*, not ἀνάπαλιν, that is, *by Contrariety*, because the right side with the right and the left with the left are ὁμόφυλα, that is, *haue a similitude of substance*. And therefore when the Spleene is affected the left side is pained and when the Liuer is offended the right. And in the second Section of the sixt Booke *Epidemion*. The paines of the sides, as Pleurisies and such like are *è directo*, that is on the same side; so also is the Tension or swelling of the *Hypochondria*, the tumor of the spleene and the bleeding at the nose. Wee will first therefore entreate of Convulsion and then of the Palsie.

The affectiõs of the partes are communicated according to *Rectitude*,

That the oppositе parts suffer Convulsion *Hippocrates* first of all men taught vs in his Booke *De vulneribus Capitis*. By oppositе parts he vnderstandeth sometimes of the head alone, sometimes of the whole body. Of the Head alone, whereas he writeth that the Veines which run through the Temples are not to be opened, because there is daunger of Convulsion, of the right side if the left Veine be opened, and on the contrary.

That the oppositе partes are conuelled *Hip.* authority

Of that convulsion which affecteth the rest of the parts of the body, he maketh mention in the same Booke. *If* (saith hee) *the Bone be purulent, then will Pustles arise in the tongue, then the patient wounded will dye idle-headed, and for the most part the other side of his body suffereth Convulsion, for if the right side of the head be wounded then will the Convulsion occupy the left parts of the body, and on the contrary.*

Many Histories.

In the fift Booke *Epidemion* he telleth of a wench whom he calleth *Puella Omilæa*, who had a bruise on the right side of her head in the middle of Summer and suffered convulsion onthe left parts. *Antoninus* had both his hands conuelled when he was stricken with a stone in the middle of the *synciput* or fore-part of the head about the mold.

In the seuenth *Epidemion*. In the History of the sonnes of *Phanius* and *Euergus* who were wounded in their heads. *In such* (saith hee) *it happeneth that they fall to vomiting and suffer Convulsions, and that in the left parts if the right side be wounded, and in the right if the left.* Wherefore I gather out of *Hippocrates* these two things. First, that Convulsion doth not alwayes follow, but onely when there is suppuration made, or whilst it is suppurating, or when there is a great inflamation. Againe, that all that are wounded doe not suffer Convulsion but the most, so that it it not perpetually or vniuersally true, that if one part be wounded, the contrarie part is conuelled.

Two thinges gathered out of *Hippocrates*.

To assigne the cause of the first Convulsion it is not hard; for if the right temporall Muscle be wounded or resolued, yet doth not a Convulsion properly so called *primarily and of it selfe* fall vpon the oppositе Muscle, *but onely by euent*, because all the Muscles are either *Antagonists* that is aduersary, or *Congeneres* that is a *Kin*: if they bee *Congeneres* then the resolution or section of one causeth the Convulsion of the other: but if they be contrarie or aduersary so that their motions succede one the other, then one of them perishing the other is necessarily taken away. For if the muscle which extendeth a part bee cut, the part will indeede be bent, but it will so alwaies remaine, because it can no more be extended, and so the Convulsion is accidentary and improperly so called.

Why one temporall Muscle is conuelled when the other is wounded.

But the Nature of the other convulsion which is of the rest of the parts of the body not of the head alone, is much more obscure, notwithstanding *Hippocrates* in the places before quoted seemeth to acknowledge the cause to bee the malignity of the *pus* or matter, which launcing the Membranes which are of an exquisite sense and pricking the originall of the sinnewes stirreth vp a depraued motion. Now there passeth from the wounded part into the sound part sometimes a breath alone, somtimes a portion of the malignant *Ichor* or humor. The breath vapoureth away thorough insensible passages, but how the *Ichor* or thin humor shoulde passe from the wounded part to the oppositе side it is not easy to declare.

The cause of oppositе convulsion is a malignant quality.

How the Ichor is carried out of the ſound part into the offended.

It muſt needs be either tranſmitted, or muſt fall downe, or be Propagated or finally Expreſſed. No man will ſay it is tranſmitted out of the wounded part into the ſound, becauſe the weaker part doth not vſe to exonerate it ſelfe into the ſtrōger; neither doth it fall down becauſe all ſuch ſinking downward is perpendicular, that is, directly downeward, for it followeth the motion of the humour, which motion ſeeing it dependeth vpon the Elementary form, as Philoſophers conclude it muſt be right and ſimple: wherefore it is either propagated or expreſſed, and both theſe I heere acknowledge. It is propagated if it abound in quantity, if the ſubſtance of it be very thin, if the quality bee very ſharpe: ſo Choler which is of Temper exceeding hot and raging when it breedeth an *Eriſipylas* or Saint Anthonies fire in the inward parts, diffuſeth it ſelfe ſometimes euen to the outward parts alſo. So ſaith *Hippocrates* in a Squinſey of the *Larynx* or throttle, both the neck and top of the Cheſt are very red, *per ἐπιγένεσιν*, that is, by conſequence or ſucceſsion. What therfore ſhal hinder the diffuſion of a thin Ichor through the whole membrane if the inflamation bee come to his height? But if there be not that plenty of Ichor that it can be propagated, yet may there be made an Expreſſion of it out of the right ſide into the left; and often there is from lower partes to the vpward a *θλίψις*, that is, a Compreſsion. Nowe Expreſsion is made by compreſsion, Compreſsion by ſuppuration, which whileſt it is a making doeth diſtend the neighbour parts, becauſe the woorking or boyling humour occupieth a greater place; and hence come paines and Agues in the time whileſt the *Pus* or Matter is in confecting, and therefore *Hippocrates* ſayeth that convulſion is eſpecially then induced when ſuppuration is a making.

Inſtances.

Hippocrates

Puella Omilæa.

In *Puella Omilæa* it is likely that the Ichor was not diffuſed, but expreſſed out of the wounded part into the part oppoſite. It may happen that a very little as it were a droppe of the Ichor may moue a convulſion, as alſo a venomous vapour, by goading the membranes of the nerues which are of moſt exquiſite ſence. Wherefore the humour which breedeth the convulſion is oftentimes expreſſed or propagated from the diſeaſed into the ſound part, neither is it neceſſary alwaies that an Ichor ſhould be expreſſed or propagated it is ſufficient if a malignant ayre breath out of it.

Two obſcure queſtions.

But here we obſerue two things very obſcure and intangled. Firſt, how the Ichor can paſſe out of the wounded ſide into the contrary, ſeeing that the braine is diſtinguiſhed into the right ſide and the left by a proper midriffe of his owne and that exceeding thick, which is a duplication of the *Dura Meninx* called the Sythe, becauſe it is like a Mowing Sythe or Sicle? The other why when as the ſame Acrimony of the *Pus* or quitture pricketh the Membrane of the wounded part, it doth not ſtir vp convulſion in the ſame but in the oppoſite part.

How the Ichor paſſeth into the oppoſite part.

The diſſolution of the former is fetched from Anatomy. The hard membrane which toucheth the Skull in the vpper and *exterior* part is wholly continuated and lined as it were or ſmeared ouer with a watry humour; betwixt it and the bone of the Skull is the purulent matter gathered, which may be both Expreſſed and Propagated out of the right ſide into the lefte by the continuity of the membrane, and furthered by the orbicular figure of the head.

A ſmall portion of the Ichor expreſſed out of the affected into the ſound ſide, ſometimes by reaſon of the tenuity ſweateth through the membranes into the marrow of the braine, and out of it into the nerues; whence comes their inflamation: ſometimes by the outſide of the membranes it falleth into the ſpinal marrow which is inueſted with the ſame membrane, where goading the originall of the nerues it procureth a convulſion by ſympathy or conſent, ſo that when the membranes are vellicated or enflamed a convulſion ſooner enſueth then if the internall or marrowey ſubſtance of the nerues were affected.

But why is the convulſion not in the wounded but in the oppoſite part? It is obſerued that ſometimes when the right ſide of the head is wounded the right parts of the body are alſo conuelled, ſometimes the oppoſite parts onely, oftentimes both together *When* (ſaith *Galen*) *the Inflamation toucheth the originall.* It is not therefore perpetually true, that when one part of the head is wounded the oppoſite part is conuelled, but becauſe it hapneth ſo for the moſt part, let vs enquire the reaſon thereof.

Why the woũded part is not conuelled

The convulſion is in the oppoſite not in the wounded part, becauſe the purulent matter which is expreſſed or diffuſed out of the wounded into the ſound part hath no iſſue but is there ſtabled or gathered and breedeth an inflamation; and from thence comes the convulſion: but the *ſanies* or *Matter* which gathereth in the wounded part hath free egreſſe by

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the wound and by the ſection of the bone, and ſo the Membrane is not affected. And this haply *Hippocrates* meaneth when in the hiſtory of the wench he ſaide, that the left parts ſuffered conuulſion becauſe the contuſion was on the right ſide. VVe may alſo aſsigne another reaſon of this conuulſion and that very probable. The wounded part is not conuelled but the oppoſite, becauſe the faculty of the wounded part is extinguiſhed and diſſolued, and the temperament which is the cauſe of all actions is notably depraued; wherefore though the faculty be prouoked yet it anſwereth not, neyther doth any motion follow ſuch prouocation. *Hippocrates.* Another reaſon of it.

Now that vpon a ſuppuration or notable inflamation the part is almoſt mortified *Hippoc.* is witneſſe in his book *de vulneribus Capitis* : but the oppoſite part hauing a quick ſenſe is preſently contracted & draweth into conſent with it all the nerues of the ſame ſide; and ſo conuulſion followeth κατ' ἰθυν by *a rectitude of veſſels.* And this our coniecture the place of *Hippocrates* aboue named maketh good. For when the conuulſion falleth vpon the oppoſite part then the caſe is deſperate, puſtules ariſe in the tongue, and the patient dyeth in a *delirium* or light phrenſie. *Hippocrates.*

QVEST. VI. *Why when the right ſide of the head is wounded or obſtructed the oppoſite part is reſolued or becommeth Paralytical.*

Concerning the Palſy the difficuly is greter, the knot harder to cleaue namely, why when one part of the head is wounded or one of the vẽtricles of the braine obſtructed or compreſſed, the oppoſite parts are reſolued or become Paralyticall ? That it is moſt true the examples are infinite, and all Phyſitions both ancient and moderne in their writings do agree vpon it. *Hippocrates* maketh mention of this kinde of Palſie in his booke *de vulneribus capitis* and *in Coacis prænotionibus. Thoſe* (ſaith he) *that becom impotent of wounds in their head do recouer if an Ague without horror ouertake them, otherwiſe they become apoplecticall in the right parts or in the left.* That is paralyticall. For *Hippocrates* often ſaith *Crus apoplecticum* for the leg taken with the Palſie. In the hiſtory of the ſonnes of *Phanius and Euergus* in his 7. booke *Epidemion* hee writeth that they become *impotent* (*if the wound be in the right part*) *on the left ſide, and on the right ſide if the wound were on the left part. Aretæus* in the 7. chapter of his firſt booke *de Cauſis et ſigmis diuturnorum morborum* is of the ſame minde. *If* (ſaith he) *the head be wounded at firſt on the right part the left ſide is reſolued; if on the left the right ſide. Salicetus* ſetteth this down for a Catholike or vniuerſall Theoreme *or Maxime. Whenſoeuer any man is wounded in the head ſo that a Palſie happen thereupon, if the wound be in the right part of the head the left ſide will be paralytical and contrariwiſe.* The ſame hath *Iohannes de Vigo* obſerued: and *Hollerius* in his Commentaries *in Coacas prænotiones Hippocratis.* And wee alſo ſaith *Laurentius* our Author, haue obſerued the ſame. That the oppoſite parts are reſolued, prooued by authorities. A hiſtory out of *Hippocrates.*

Wherefore that it is ſo, there is no controuerſie; all the queſtion is, *why and how* it commeth ſo to paſſe, and that indeed is much diſputed. Some imagine that the nerues in their originall are ſo implicated that the right nerues run along the left ſide and the left along the right ſide, interſecting themſelues in manner of a S. *Andrewes* Croſſe, which interſection is called χιασμὸς and therfore it is, ſay they, that when the right part is obſtructed or otherwiſe affected the left ſide is conuelled or reſolued and on the contrary, becauſe the originall is affected. And this is the opinion of *Caſsius* and *Aretæus*. *Caſsius* thought that the nerues do ſo take their originall from the Baſis of the Braine, that thoſe which aroſe from the right part were carried into the left, and thoſe which aroſe from the left ſide into the right, croſsing one another ouerthwart. *Aretæus* is of the ſame opinion. The right nerues, ſaith he, do not proceede directly into the right parts vnto their terminations; but as ſoone as they ſpring vp they cut ouer to the other ſide croſsing one another like the letter X which the *Græcians* call χιασμὸν. But the leuity of this opinion needeth no confutation. For ocular inſpection which wee call αὐτοψία teacheth vs that all the nerues which ariſe out of the marrow of the braine are altogether diſtinguiſhed and ſeperated in their originall, progreſſe and inſertion; excepting onely the opticks which in the middle of their iourney do meet & that neceſſarily, that they might paſſe directly to the apple of the eye; that they might not grow flaccid or looſe in their long iournybeing very ſoft; that the ſimple & ſingle obiect of the eye might not ſeeme double: and finally, that the formes and images of viſible things might be vnited. Onely therefore the opticke nerues do meet, Diuers opinions how this Palſie commeth. The firſt. Of *Caſsius* and *Aretæus* that the nerues croſſe one another. Confuted. χιασμὸς. None but the opticks doe interſect.

yet

yet ſo that they neuer interſect or croſſe one the other. VVee haue alſo of late obſerued, ſaith *Laurentius*, that the netues of the ſecond coniugation haue beene continuall in their originall.

As for the nerues of the ſpinall marrow, the right are ſeparated from the left, neuer cutting one ouerthwart another. It is therefore abſurd to referre the cauſe of the convulſion and Palſie which hapneth on the aduerſe ſide to the interſection of the nerues & their Croſſe permutation as *Aretæus* would haue it, becauſe it is a meere fable.

The 2. opinion that the ſpirits paſſe by the arteries which interſect.

Some conceiue that not the nerues, but the veines and ſmall arteries of the braine are implicated firſt in the baſis of the braine, then in thoſe two labarynthian textures, the one called *Choroides*, the other *Rete mirabile*, ſo that they are diuaricated out of the right ſide into the left, and out of the left ſide into the right. They thinke therefore that when the ventricle on the right ſide of the braine and the parts therof are obſtructed or compreſſed, the left ſide is conuelled or reſolued becauſe the entercourſe of the ſpirites is intercepted by the oppreſsion or obſtruction of their common fountaine, and at length by ſtopping of the way of the ſpirit which they perſwade themſelues is communicated to the whole body by the arteries not by the marrowey and inward ſubſtance of the nerues. I cannot but acknowledge this conceite to bee very ingenuous and ſeemingly true if it were not that it is contradicted by the principles of Anatomy. For to winde vp the matter in a few words, this opinion taketh theſe two poſitions for good. Firſt, that the veſſels doe interſect or croſſe one another, and againe that the Animall ſpirites are conuayed by veſſelles not by the marrow of the nerues; which, how diſſonant they are from the trueth may thus be demonſtrated by the two common and moſt competent iudges of all Controuerſies, reaſon and ſence.

Confuted.

The diuarication of the veſſels of the braine.

All the veſſels which irrigate or water the whole body of the braine and his membranes are propagated from the internall Iugular veine and from the arteries called *Carotides* and *Ceruicales*: now we are taught by ἀυλοψία or ocular inſpection, that the diuarication of theſe is on this manner.

The right *Iugular* veine powreth the bloud into the right *ſinus* of the *dura mater* as it were into a Ciſterne, and the left into the left; out of the συνδρομὴ or *Concourſe* of theſe two ariſeth the third *ſinus*, which running through the length of the ſagittall ſuture is conuayed to the top of the noſe, and from this many ſmall veines are diuerſly diſperſed into the *pia mater*: the fourth *ſinus* concaued between the Braine and the After-brain determineth at the buttocks of the Braine.

The *ſinus* or dupliteation of the *dura meninx*.

Theſe *ſinus* as it were riuerets ſubſtituted by Nature inſtead of veſſels, doe diſperſe the bloud on al hands, and from them as out of a preſſe, the bloud ariving vnto them from the *Iugular* veines, is expreſſed into the whole body of the Braine. The *Iugular* veines therefore doe meete and vnite themſelues in the third and fourth *ſinus* of the *dura mater*, but yet are neuer ſo implicated that the right doe paſſe vnto the left ſide, or the left vnto the right; there is no interſection of theſe veſſels no χιασμὸς. Neither is there any interſection of the right *Carotidall* or *ſleepy arteries* with the left, becauſe they doe not power vitall ſpirits into thoſe *ſinus* or duplications of the membrane as the veines doe the bloud, neyther are the right implicated with the left, but each artery maketh his owne texture, the right artery the right texture and the left the left.

The arteries of the brayne do not interſect.

Theſe textures or complications which are manifeſt in the vpper ventricles and called *Plexus Choroides* doe neuer ſo interſect themſelues that the right ſhould paſſe vnto the left, the left vnto the right parts, for the vpper ventricles are diſſeuered by their proper wall or diſtinction

And if they ſay that the *Carotides* are implicated in the Baſis of the braine at the ſides of the buttockes and there interſect themſelues. I will indeede confeſſe that the arteries of the ſame ſide are implicated, that is, are contorted manifould like the tendrilles of a Vine crumpled vp together for the better preparation of the ſpirits: but that they interſect themſelues and from the right ſide paſſe vnto the left, that I conſtantly deny. For the holes of the buttocks do ſtand off one from the other, through which the arteries aſcend to the Baſis of the braine, and from them καλῖξιν or by a right line to the vpper ventricles: which he that will not otherwiſe beleeue may thus proue by his owne experiẽce. Put a hollow Probe of Bugle into the right *ſleepy* arterie and blow it, and you ſhall perceiue that the arteries of the right ſide will be diſtended more then the arteries of the left. Let vs therefore cleare our conceites of this miſt and cloud of errour concerning the interſection of the veſſelles

Experience.

which

which *Autopſie* it ſelfe conuinceth to be a forged conceite.

Beſide experience we haue good reaſon alſo againſt it: for if we admit this interſection of the veſſels, then it wil neceſſarily followe, that whenſoeuer the right partes are ſtuffed or compreſſed the left parts ſhalbe reſolued; becauſe the courſe of the ſpirit is intercepted. But wee finde it often to fall out, that when the right Ventricle is obſtructed the parts of the ſame ſide are reſolued. But let vs for diſputation ſake admit (though wee do not grant it) that thoſe ſmal arteries and complications of them do interſect one another, muſt it thervpon needes follow that when the veſſelles are compreſſed the Palſye ſhould ſeize vppon the contrary ſide? The arteries are onely conceptacles of the Vitall ſpirits. Thoſe Vital ſpirits do onely conferre their helpe to the cheriſhing, rowzing vp, and reſtoring of the in-bred heate of the particular parts, but affoord no helpe at all to motion or ſenſe. Now in the palſy the part liueth though the Motion and Senſe be both of them quite intercepted. Wherefore by the Arteries the Animal ſpirit is not conueyed which is the author of all ſenſe and motion.

Reaſon.

The Arteries do not conuey the Animall ſpirits.

I know well that when the Iugular Veines and the Carotidall arteries are obſtructed, the *Caros* Apoplexy and Lethargie do follow; whēce the Carotidal Artery is called *Lethargical* and *Apoplectical*, and *Hippocrates* vſeth to call that kinde of Apoplexie, τῶν φλεβῶν ἀποπληξιν, *the interception of the Veynes*: but this Apoplexie hapneth but by accident and is cureable, wherein acceſſe is denied to the vitall ſpirite which miniſtereth matter to the Animall. But the Queſtion in this place is of a true Palſy which happeneth vpon the exolution, madefaction, and (that I may vſe the Arabians word) Mollification of the Nerues, or when the wayes of the Animall ſpirits are ſhut vppe or intercepted. Theſe wayes are the Nerues, which albeit they haue no conſpicuous cauity, yet is their inward ſubſtance altogether ſpongie, through which the Animal faculty and thoſe impetuous ſpirits which *Hippocrates* calleth λὰ ἐνορμῶντα do eaſily finde their way.

A light kinde of Apoplexie whence.

Many learned men there are, who will not admit of this trueth, and eſpeciallie among the late writers *Rondeletius* ſtriueth to prooue that the Animal ſpirit is conueyed through the Arteries not through the marrowy ſubſtance of the Nerues: the onely vſe of the Marrow he acknowledgeth to bee, that like flockes it may ſuſtaine and ſtrengthen the ſmal and ſlender veſſels. *Argenterius* alſo thinketh that the ſpirits neuer forſake the Arteries.

Rondeletius opinion that the Animall ſpirits paſſed through the Arteries.

It was an old opinion of *Praxagoras* as *Galen* remembreth in the 7. chapter of his firſt Booke *De Placitis Hippocratis & Platonis*, that the Nerues were continuated with the Arteries, and that the Nerues were nothing elſe but Arteries become now ſlender and ſmal. But the weaknes and inſufficiency of this opinion is hence conuinced, becauſe the intercoſtal Arteries are ſmal & threddy, & the arteries of the brain which make the two textures therof as fine as haires, and yet no man euer durſt call them Sinews. But of this we ſhall haue better occaſion to diſpute in our booke of the veſſels. In this place it ſhal be ſufficient to haue ſaide that the Animal ſpirits cannot paſſe by the Arteries becauſe they were deſtined and ordained by Nature for the tranſportation of the Vital ſpirites: now two ſpirits diſtinct in *forme* and *kinde* as we vſe to ſay, cannot be conueyed by the ſame Veſſels. When the Opticke Nerue is obſtructed the action of the ſight periſheth, are there then any ſmall Arteries intercepted? Or is their interception the cauſe of blindneſſe? Nothing leſſe, for the part ſhould be vtterly extinguiſhed if it wer no more illuſtrated with the beames of the Vital ſpirits. Wherefore when the marrowy ſubſtance is affected, when the ſpondils or rack-bones are luxated he body is often reſolued, becauſe the Marrow of the Nerue is preſſed, by reaſon of which compreſsion the paſſage of the animal ſpirit is intercluded.

Praxagoras opinion out of *Galen*.

Confuted.

That the Animall ſpirites paſſe not by the Arteries.

Diuers Arguments.

In thoſe that are afflicted with the Stone, the legge on the ſame ſide becommeth ſtupified, the Nerues and Muſcles which are ordained to bend it being compreſſed by the Kidnie lying thereupon. As for thoſe ſmal Arteries which run thorough the Membranes that couer the nerues they miniſter the ſpirit of life vnto the Nerues, not the faculty of Senſe and Motion. Againe, the Arteries of the braine do not eſſentially differ from other arteries, but other where the Arteries neyther engender nor conteine Animall ſpirits, therefore not in the braine.

Add heereto, that the forme of euery thing is ſtamped vpon the aliment and the ſpirit, onely by the ſubſtance of the part: now in thoſe complications there is onelie a power to prepare and as it were to delineate the ſpirites, their forme they haue onely

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from the Marrowy substance of the braine. Finally, as the Braine by reason of this marrowy substance is called the braine, and this marrow is the principal part of this noble Organ the seate of the Memory, Reason and Discourse: so I thinke that the chiefe part of the nerue is the marrow thereof, which carrieth the commaundement of the Sensatiue and Motiue Faculty, not onely by irradiation but by a corporeal spirit. And therfore it is that *Galen* in his eight Booke *de vsu partium* calleth the braine *Nervum ampliſſimum & moliſsimum*, *A soft and large Nerue*; and againe he calleth a nerue *Cerebrum durius & reſiccatum*, *A hard and dryed Braine*. But if (as *Rondeletius* conceited) the inwarde part of the nerue hadde beene onely ordained for the establishing and sustaining of the final Arteries ioyned to their Membranes, then certainely is the Marrowye part of the nerue the baseſt and most ignoble.

Let therefore the opinion of *Galen* and of the Ancients remaine with vs as current and Cannonicall, to wit, that the Animall spirits passe through the marrow of the nerues not through the Arteries.

The cause of the palsie in the opposite part.

These things being thus established, it remaineth that we discouer the cause of the palsie which happeneth on the contrary side to the wounded or affected part. When the right part of the Head is wounded a portion of the *Ichor* may fall *καθ' ἴξιν by Rectitude* into the right fore ventricle; now out of it into the third (which is common) there is a manifest passage, (this Ventricle *Galen* calleth the middle either because it is in the very center of the Braine, or else because it is scituated betwixt the two vppermost and the fourth Ventricle which is the lowest) and the humour conteyned in that Ventricle is as it were in the center of the Braine. Wherefore if it follow the Motion of the Elementary forme it must fall into a lower place: now the sound part is alwayes the lower, because the patient euer leaneth or lyeth vpon the sound side not vpon the sore side for auoyding of paine. What therefore should hinder but that the humour may fall out of the thirde ventricle into the fourth, and from thence into the spinall marrowe on the opposite part vnto that which is wounded, and so that part become Paralyticall or resolued? The Braine is not as some haue dreampt diuided from the top to the very bottome; the vpper Ventricles determine into a common cauity into which they thrust downe their superfluities. This common cauity is directed into the fourth Ventricle which is common both to the After-braine and the spinall Marrow. It is not therefore against our Anatomicall Principles or groundes, that *Matter*, *Flegme and Blood* may be transmitted from the right Ventricle to the thirde, and from hence through the fourth Ventricle into diuers parts of the spinal marrow, now into the right side and now into the left, as either of them is lower or weaker.

Another reason.

Another reason also may be brought of the palsy in the sound part not in the affected, because Nature vseth to auoyd the excrementitious humour by the wound, as sometimes by a flux of blood, somtimes by quitture, sometimes by Medicines which draw away and exhaust the humour either sensibly or insensibly, so that the affected part is well purged by some or more of these meanes; but the opposite part which is not expurged is easily affected either by sympathy or when the matter is transmitted or falleth vpon it.

Another.

Some thinke that almost all the spirits do flow to the part wherein the tumor or inflamation is, whence it is that the opposite part being defrauded of them is resolued.

QVEST. VII. *VVhat is the Nature of the animall spirit, what is the manner of his generation and the place thereof.*

WEe haue sufficiently prooued by strong Arguments that to Motion & Sense is required not onely an influence of a Faculty but also of a corporeall spirit. Now what name we shall giue this spirit, what his nature is, what is the manner and place of his generation we will breefely declare.

What is the animall spirit *Galen.*

Galen calleth this spirit euery where *Animalem* the Animall spirit, because the Soule vseth it as her immediate Organ for the performance of all the animall functions of sense and motion and those which we commonly call Principall.

This spirit in the 17. chapter of his sixt Booke *de Vsu partium* he defineth to bee an exhalation of pure blood. Some thinke it to be a part of the liuing Braine, yea both a Similar and an Organicall part: Similar as it hath a certaine and designed temper, Organical as it is thin, lucid, subtile, pure and moouable.

This Spirit some haue thought doth not differ in kinde and nature from the Vital but onely in accidents, as in temperament, place, the originall *à quo*, and the manner of diffusion.

sion. For the Animall spirit is moyster and more temperate, the Vitall hotter. The Animall commeth from the braine, the Vitall from the heart; the Animall is disperſed through the nerues for Motion and Sence; the Vital through the arteries to maintayne the life.

We are of opinion that theſe two ſpirits are of a diuerſe forme and kinde, as Chylification is diuers from Sanguification. For the Organs are diuers, the faculties diuers, diuers is the manner of Generation: and as the Aliment by a new concoction receiueth a newe forme and ſo a new denomination, ſo is it with the ſpirits. *Galen* in a thouſand places diſtinguiſheth this Animall from the Vitall ſpirit, whatſoeuer ſome new Writers ſay to the contrary. In the 5. Chapter of the 12. Booke of his Method. *The Animal ſpirit* (ſayth he) *ariſeth out of the Braine as out of his fountaine.*

The vital and animal ſpirits differ in form & kinde.

The demonſtration of the Vitall ſpirit is not euident, but yet it is agreeable to reaſon that it is contayned in the heart and the arteries. And if there be any Naturall ſpirit that is included in the Liuer and the veines. In the 7. Chap of his 3. Book *de locis affectis Gal.* ſaith, The *Epilepſie* hapneth in the braine when the humour hindreth the Animall ſpirit which is contayned in the ventricles thereof that it cannot haue yſſue out. In the 10. Chapter of his 16. Booke *de vſu partium.* The complications of the arteries doe nouriſh the Animall ſpirit contayned in the braine, which differeth much in Nature from other ſpirits. In the third Chapter of his 7. Booke *de placitis Hip. & Plat.* The ſpirit which is contayned in the arteries is indeed Vitall and ſo is alſo called; that which is contayned in the braine is Animall, not that it is the ſubſtance of the Soule, but becauſe it is the Soules firſt and moſt immediate inſtrument. The ſame alſo he writeth in the 4. Chapter of his 9. Book *de vſu partium*, In the 8. Chapter of the 9. Booke *de placitis Hip. & Plat.*, and in the 5. Chapter of the ninth Booke *de vtilitate reſpirationis.*

Diuers places in *Galen.*

By all which places we may gather that *Galen* made a difference betweene the Vitall and the Animall ſpirits. And truely that there ſhould be an Animall ſpirit it was very neceſſary; firſt to conuay vnto the partes the facultie of Motion and Senſe which is not fixed in them; and againe that we might be more apprehenſiue of outward accidents. For ſeeing that the Organs of the Sences ought to be affected on the ſudden by ſenſible things, it was fit they ſhould not be altogether ſolide, but houed and fulfilled with ſpirits that they might the ſooner be altered. Moreouer theſe ſpirites doe transferre the *ſpecies* or formes of all outward things perceiued by the outward Sẽces vnto the brain as vnto a Cenſor or Iudge. The ſame ſpirits doe conceiue in the braine the images of thoſe outward thinges, ſo that the Animall ſpirit may bee called the place and promptuarie of the *ſpecies* or formes. So in the *Vertigo* or Giddineſſe neither the thing it ſelfe, nor the Image of it, nor any thing beſide the ſpirit is rowled about, and yet notwithſtanding all things ſeeme to him that is ſo affected to runne round. VVherefore this ſpirite is neceſſary both for motion and ſence. As for the principal faculties; to the performance of all their functions the braine vſeth the miniſtery and helpe of this ſpirit; ſo that it worketh both within the braine and without the braine: within the braine it helpeth the principall faculties; without the braine it conferreth Motion and Sence. Nowe it is not onely abiding in the ventricles but alſo in the pores and in the whole marrowy ſubſtance of the braine, ſo that in the pores and ſubſtance it is communicated to the principall faculties: In the ventricles it ſerueth more immediately for Sence and Motion.

The neceſſity & vſe of the animall ſpirit.

The nature of the *Vertigo.*

Furthermore this ſpirit which is the immediate Organ of Sence and Motion and of the principall faculties, is indeede of one kinde notwithſtanding it is eſteemed manifould according to the variety of the obiects and inſtruments where about it is imployed: which thing *Ariſtotle* elegantly hath taught vs in the laſt chapter of his 5. booke *de generatione Animalium.*

How the animall ſpirit is manifold.

The ſpirit ſayth he in Naturall things is like the hammer in the Art of the Smith, that is to ſay, but one inſtrument, yet profitable for the performance of many offices. *Actuarius* compareth it to the beames of the Sunne, which though they bee all of one kinde yet they become vnlike when they light vpon different colours.

It remayneth now that we ſhould manifeſt vnto you the Matter of the Animall ſpirit, and the manner of his generation.

The matter of the animall ſpirit.

The matter of it is double, Ayre and the Vitall ſpirit.

The Ayre is drawne in by the noſethrils; the Vitall ſpirites are conuayed through the Arteries called *Carotides* and *Cervicales* into the Baſis of the braine. VVith this Ayre the ſpirit is nouriſhed, and therefore *Galen* acknowledgeth a double vſe of Reſpiration, to witte, the con-

conseruation of Naturall heate and the Nutrition or Generation of the Animall spirites. Now if the passage of these two matters to the braine be intercepted, then will there be no generation of Animall spirits. If the *sleepy* arteries be bound an *Apoplexy* ensueth, if Respiration bee prohibited the Creature dyeth instantly and is depriued of Sence and Motion.

Galen concerning this poynt seemeth to differ from himselfe, but we will reconcile those different places well enough. In the 5. Chapter of his book *de vsu Respirationis* he sayth, that in a liuing creature he tyed the Sleepy Arteries and yet the creature perished not: therefore it followeth his Animall spirit was nourished onely with Ayre not with the vitall spirit. In his third booke *de placitis* and in the 9 booke *de vsu partium*, hee writeth that the Animall spirit may bee cherished and sustained with the vitall conueighed by the Arteries and maketh no mention at al of the Ayer.

Certaine places of *Galen* concerning the Animall spirit reconciled.

Wee answere, that the Animall spirit may be for a little time sustained if it be depriued of eyther of his Aliments: for there is stored vp a supply against time of need in those two complications or textures called *Plexus Choroides* & *Rete mirabile*, but long that supply will not maintaine them.

Where the Animal spirit is prepared.

The preparation of this spirit is made in those Labyrinths of the small Arteries, their coction or elaboration (as some think) in the ventricles; and finally, their distribution into the whole body of the braine and into the sinewes.

They therefore are in an error who do conceiue that this spirit attaineth his proper forme and specificall difference in those textures. For all the complications of vessels as well in the braine as in the testicles and other parts are ordained onely for preparation, but the forme and difference of a thing is supplied by the substance of the part, both to the Aliment and to the spirit.

Where laboured and perfitted.

VVherefore we conclude, that in those complications the spirits are prepared, that in the ventricles they are boyled and labored, but receiue their vttermost perfection in the substance of the Braine.

QVEST. VIII. *Argenterius his opinion concerning the Animall spirit confuted.*

Argenterius an accute Scholler indeed, but whose pen especially against *Galē* yeeldeth too much gall, in his booke *de somno et vigilia*, and in his Commentaries in *artem medicinalem* auoucheth, that there is but one spirit & that Vitall, neither will he bee brought to admit any Animall spirit at all. And first as his custome is, he inueigheth bitterly against his Maister *Galen* accusing him sometimes of leuity and inconstancy, sometimes of ignorance. Of inconstancy in his assignation of the matter and the place of generation of the Animall spirit. In the matter, because sometimes he writeth that it is made of the ayre we breathe in, sometimes of the vitall spirits, sometimes of bloud. In the place of generation, because hee assigneth it sometimes to bee generated in the Textures or complications of the Braine, sometimes in the forward ventricles, sometimes in the backward, sometimes that it is contained in the body and substance of the braine.

Argenterius accuseth *Galen* of inconstancy.

But *Argenterius* wit was to nimble to fasten vpon the depth of *Galens* iudgement, which if he had well attended he should not haue found repugnancy in him. For the most remote matter of the Animall spirit is bloud, the neerer matter is vitall spirit, the neerest of al is ayre inspired or breathed through the mammillary processes, & conuaighed not into the textures but into the vpper ventricle. And as the matter, so also the place of their generation is manifold; for they are prepared in the Textures & vpper ventricles, boyled in the third and perfitted in the fourth or in the substance of the braine. Finally, they are diffused into the nerues, and from them conueighed into the bodye.

He vnderstandeth not *Galens* meaning.

He accuseth *Galen* of ignorance, because from the *Net-like texture* he gathereth that ther is an Animall spirit, because saieth *Argenterius*, neyther is that Texture conspicuous in a man, neyther is there alwayes required a complication of vessels where there is any spirit generated. For in the heart where the vitall spirit is aboundantly generated there is no such admirable web of vessels.

Galen accused of ignorance.

But defended

But *Argenterius* was so headily transported with a desire of contradiction, that he did not obserue the tenor of *Galens* Argument; for he neuer concludeth that therefore there is an Animall spirit because in the braine the vessels are intangled and interbrayded one

with

with another, but he saith that this spirit is irrigated or watered & nourished by that which that Net-like web supplyeth vnto it as we haue read in the 5. chapter of the 12. booke of his Method, and in his 7. booke *de placitis. Hip. et Plat.* and the third chapter. But let vs yeelde that *Galen* meant as *Argenterius* vnderstandeth him: shall wee therefore conclude that he hath written absurdly? Nature is not wont to create any such texture vnlesse it be for a new elaboration, but in the braine there appeareth a notable texture which we call *Choroides*, therefore in the braine there is a preparation of a new spirit. *Argenterius* wil obiect that in the left ventricle of the heart the vitall spirit is generated, and yet in the heart there is no complication of vessels. Obiection.

Wee answere, that such Laberynths were not necessary in the heart, because the necessity of the vitall spirit is greater then that of the Animall. And therefore there is a greater proportion of them required then can be confected in so narrow vessels. For the Animall functions are not perpetuall, and beside when a man sleepes they are also at rest. But the vitall, the sounder we sleepe the stronger they are. Answere.

Furthermore, all the parts of the creature haue not sence, as bones, gristles and ligaments yet all of them do liue. VVherefore because there is a greater exhaustion of vitall spirits there restauration must be ἀθρόως that is, sudden and plentifull. Adde heereto that the vitall spirit doth not onely serue for the accomplishment of the vitall functions, but also is the matter of the Animall spirits: and therefore it is necessary that their generation should be in great aboundance, which cannot be accomplished in small Arteries and narrow cauities. Finally, the heart which is the hottest of al the bowels doth suddenly boyle & generate spirits albeit there be not so precise a contaction in al the parts; which thing the braine being far colder cannot performe and therfore in the brain there was great vse and necessity of complications of vessels and not in the hart. *Argenterius* proceedeth to goade *Galen* farthet. VVhy are the Animall spirits generated in the complications of the Arteries of the brain, seeing the Arteries of the brain do not differ *in kind* from the arteries of the ther parts of the body? Now in the other parts the arteries do not generate Animal spirits; therfore they shal not do it in the brain. I answer, that the Animal spirit doth not attain his *forme* & *difference* in the cõplications, but eyther in the ventricles or in the substance of the brain. In those straights and narrow passages it is only prepared, and attaineth a kind of rudiment or initiation by irradiation from the braine. So in the crooked rings of the preparing vessels the seed hath a delineation from the influce of the testicles. In the mesaraicks the blood is prepared by a vertue beaming from the Liuer: neyther did *Galen* euer acknoledge any other vse of those complications then the attenuation of the vitall spirit and the preparation of the animal. Fourthly, that there is no animal spirit he thus proueth. If in the brain a spirit wer cõtained, thẽ our sensations & cogitations should be perpetual, because the faculties of the soule are euer prest and at hand. I answere, that the soule doth not alwayes worke though it haue an Organ; because the Organ is often hindred, as when the naturall heate is drawne inward, for example in sleepe. Againe, there is not alwayes a sufficient supply of Animall spirits, and thence it is that the functions doe not alwayes worke, but sometimes rest themselues as in the night, in which time the spirits are redintegrated and refreshed; and this according to Phisitians is the onely finall cause of sleepe or rest. Fiftly, he obiecteth that thogh it should be granted that there is an Animall spirit, yet it cannot descend to the feete because it is of a fiery and airy Nature. But this argument is already answered thus: That all the spirits by their proper motion are carried vpward and outward: but when they are directed by the soule they are diffused and dispersed into all the parts of the body. So the Arme being naturally heauy, is often times depressed by his Elementary forme, yet it is lifted vp againe by the soule; for our naturall heate is by diffusion communicated to all the parts. Sixtly, if there be more kindes of spirits, then (saith *Argenterius*) it will follow that they must be mingled & confounded, which confusion of the spirits will also induce eyther a confusion or nullity of the actions. But let vs grant (which yet is not true) that the spirits are confounded, will it thence follow that euery spirit shall not performe his owne office? VVhy may not the vitall do the offices of life and the Animall supply sense and motion? For these spirits are not contrary, that in the permistion they should abate their power & force mutually. Seauenthly, he saith, that the pupilla or apple of the eye is dilated by the spirit of the arteries which is vitall and not Animall. On the contrary, we thinke that when one eye is closed vp the apple of the other cannot in a moment be dilated by any spirits proceeding from the arteries, because the arteries of both the eyes doe not meete and vnite themselues as do the optick nerues. *Argenterius* 4 Argumẽt. Answere. The fift answerd. The fixt. Answered. The seuenth.

But there is a great distance betwixt them, and so great as that it is impossible that the Vitall spirit together with the arteriall blood should so instantly moove it self from one eye to another.

The eight. Eightly, hee obiecteth that the influence of an Animall spirite is not necessarie, a quality onely or beaming light might be sufficient, for nothing that is corporeal is moued in an instant. But we know that the Muscles obey the Braine according as our will commandeth thē, for we are able in the twickling of an eye to moue our vtmost ioynts.

Answered. We answere that the spirit which is the Organ of the soule dooth instanly accomplish the commandement thereof and is euer addrest in the Nerues, and as it is spent repayred by new influence and succession; whence it is that before the exhaustion or expense of the olde a newe is ministred to supply the roome. Which *Lucretius* in an elegant Verse hath thus chanted.

Ergo Animus cum sese ita commouet vt velit ire
Inque gredi, fert extemplo quæ in corpore toto
Per membra atque artus animali dissita vis est:
Et facile est factu, quoniam coniuncta tenetur.

When the Soule listeth her selfe to disport, The Powers throughout the bodie disioyned,
Into the Ioynts and Members resort, For the Soule holdeth them alwaves conioyned.

Argenterius conclusion. Finally, he concludeth that there is but one influent spirit because there is but one soul, one influent heats, one nourishment of the parts, to wit, the blood and one aire that is inspired. These are *Argenterius* Darts which he casteth against *Galen*, which howe light they are and little sauouring of Physicke let the learned iudge. True it is that the soule is but one, but that one is furnished with diuers Faculties: there is but one Aliment, but by diuers concoction it receyueth a diuers forme, and that one according vnto the diuers substance of the parts is of diuers sorts.

Our conclusion. As therefore there are three Faculties of the Soule, the Naturall, Vitall and Animall; three principles, the Braine, the Heart, and the Liuer; three Organs ministering vnto them Veines, Arteries and Nerues: so are we to thinke that there are three spirites distinct in forme and kinde, otherwise all thinges should bee one because the common matter of all is one and the same.

Other reasons to proove there is no Animal spirit. There be other weapons farre keener then these of *Argenterius*, wherwith we may affront the opinion of *Galen* concerning the Animall spirit, which for disputation sake and that the truth may be better cleared we will thus vrge. Whatsoeuer spirit is conteyned in the Cauity of the Arteries is to be accounted Vital. But all the spirits conteined in the Braine are included within the Arteries, neyther doe they euer yssue out of them, and therefore the spirits of the Braine are Vitall and not Animall.

The first. The Minor proposition or assumption is thus confirmed. If the spirites boult out of the Arteries then are they conueyed either into the Ventricles or into the substaunce of the Brain, which if we admit, then wil the spirit becom presently condensed. For the scalding Vapors which arise into the Braine from the bowels boyling with extraordinarie heate are much thinner then the spirits and yet are instantly condensed or thickned.

The answere. Now that the Vapor is thinner then the spirit may be prooued, because the vapour exhaleth outward, the spirits remaining within. To this argument wee answere, that the Nature of Spirits and Vapors is diuers. The spirits are retained by the Soule, beecause they are familiar and as it were of Kin vnto her, but the Vapors are straungers or rather Enemies, and therefore they exhale and are condensed or thickned.

Another Reason.

The second. If the Spirits of the braine do forsake the Arteries and be transfused into the Ventricles, seeing in the third Ventricle there are two passages, one forward and another backward, why do they rather passe backward then forward? whereby shal it bee conducted

Answered. after it fal out of the Arteries so that it mooue in a right line, and that without any violence but with an easie and gentle motion into the fourth Ventricle. I answere, that it is the Soule that directeth the Instruments of the soul, and that it is diffused into this part rather then into the other, because it is the Soules good pleasure so to command.

The third. Thirdly, it seemeth not consonant to reason that a Spirit should be generated & conteyned in the Ventricles of the Braine, because those Ventricles were ordained for the

Answered. expurgation of superfluities. I answere, that Nature vseth one part for diuers vses, for as the Nose was primarily created for smelling and the inspiration of aer, and secondarily for the expurgation of the Braine; so it may be that the forward ventricles of the braine

were

were primarily made for the preparation of the ſpirits, and ſecondarily to auoide excrements.

Fourthly, that whereas one eye being ſhut, the apple of the other is dilated. It argueth that the ſpirits are not tranſported by the nerues but by the Arteries. For the optick nerues do not touch the apple of the eye, yea betwixt them are interpoſed many boddies and thoſe very thicke, to wit, the Chriſtaline and the Wateriſh humors, through which the ſpirits in ſuch a momẽt cannot paſſe. For if it cãnot pearce through a drop of phlegme in the oppilation or ſtopping of the optick, which maketh the diſeaſe we call *Gutta ſarena*; how ſhall it paſſe the thickneſſe of the Chriſtaline humor? The ſpirit therefore yſſueth through the ſmall Arteries, which together with the *grape-like* coate are conuyghed to the *Pupilla*. This reaſon would vrge very much vnleſſe Anatomy did teach vs that the optick nerue when it commeth vnto the Chriſtaline humor doeth not there determine but is diffuſed and amplified into that coate which is called *Reticularis* or the Net. Now the *Net-like* coate paſſeth euen vnto the apple. The fourth. Answered.

Finally, that there is no Animall ſpirit may thus be demonſtrated. The ſpirits are thoſe that do conueigh and tranſport all the faculties, and ſerue onely for that vſe. Now there is no Animall faculty tranſported from the braine into the body, and therefore there is no Animall ſpirit. That the Animall faculty is not tranſported from the braine into the body may thus be prooued. The fift.

A faculty is a propriety of the ſoule, now euery propriety is inſeparable from that thing whereof it is a propriety. Wherefore whereſoeuer the ſoule is, there alſo ſhall his faculties be. But we know that the ſoule is *Tota in toto et tota in qualibet parte*, that is, wholy in in the whole and wholy in euery part. Whence it will follow that the faculty is not only in the braine but alſo in euery part of the body, and that as abſolute and perfect as it is in the braine it ſelfe, becauſe the whole ſoule is abſolute and perfect in the leaſt part.

The Philoſopher makes anſwere, that the eſſence of the ſoule furniſhed with all her faculties is indeed euery where; but doth not worke euery where becauſe euery where it hath not Organs. For the Soule doth not moue neyther partaketh of ſenſe without the Animall ſpirit, as it ſeeth not without an eye. Answered.

VVe conclude therefore that there is an Animall ſpirit which receiueth an inchoation in the Textures, an elaboration in the ventricles, & a perfection in the ſubſtance of the braine, where alſo it is the vehicle of the principall faculties, and paſsing into the ſpinall marrow and the nerues is the immediate Organ of ſenſe and motion.

QVEST. IX *Whether the braine be moued by a proper & In-bred faculty, or by the motion of the Arteries.*

IT is a very hard and difficult queſtion whether the brain be moued by a proper and ingenit power of his owne, or by ſome outward violence. That the braine is moued no man in his right wits will deny vnleſſe he bee vtterly ignorant of Anatomy. For in great wounds of the head wherein the Scull is broken and the membranes are detected, there is a manifeſt motion to be ſeene. Againe, in children new borne the forepart which we call the mould of the head doth ſo conſpicuouſly pant and beat, that the very bones of the Scull which at that time be exceeding ſoft are moued therewith. That the braine is moued voluntarily.

But becauſe among the Philoſophers there is a threefold kinde of motion, the firſt naturall, the ſecond Animall, and the third violent. It is a great queſtion to which of theſe kindes the motion of the braine is to be referred. It ſeemeth to ſome that the braine cannot be the originall of the Animall motion vnleſſe it ſelfe be moued voluntarily; for it were abſurd to ſay that there yſſued from the braine into the whole body a power or faculty which doth not reſide therein as in the fountaine and originall.

But this opinion hauing no ſtrength of argument to ſupport it, hath alſo beene little ventilated by the Phiſitions. For an Animall motion is *proairetical*, or with choice being intended, remitted or intermitted according to the arbitriment of our will. Now wee know that the braine is not moued at our diſpoſe, but according to it owne inſtinct, and therefore the motion thereof is not voluntary.

No man will ſay that it is violent; for *Ariſtotle* in his ſecond book *De ortu*, oppoſeth that which is violent to that which is according to nature. It remaineth therefore that it is naturall. By naturall I vnderſtand not that which is only directed by Nature, but whatſoe- Diſproued. That it is not violent.

tier is not voluntary although it be gouerned by the ſoule.

Now whether this motion be of the whole braine or onely of the parts, and whether it be moued by an in-bred faculty or a power from without, that is, from the Arteries and the ſpirits it is greatly contrauerted. *Galen* in the ſecond chapter of his fourth booke *de differentijs pulſuum* ſaith, that ſome thinke that the membranes onely do beate, others only the body of the braine, others both the membranes and the braine it ſelfe. Some are of opinion that the Animall ſpirits onely are moued not the bodye of the braine, which they illuſtrate by the example of a *Vertigo* or giddineſſe wherein all things ſeeme to runne round, becauſe of an inordinate and Turbulent motion of the ſpirits. The vulgar opinion is that the braine is not moued by any proper motion of it owne, but by a motion from without, that is to ſay, from the Arteries. Neither do his ventricles breathe in aer, (as *Galen* would haue it) neyther are they diſtended and contracted.

The first opinion.

That the braine is moued according to the motion of the arteries

The reaſons of this are: firſt it doth no more become a principle of motion to bee mooued, then it becommeth a principle of ſenſe it ſelfe to haue ſenſe, becauſe as *Ariſtotle* ſaith, euery διαθητήριον muſt be ἄπορον that is, euery inſtrumēt of ſenſe muſt be deſtitute or void of al the obiects of that ſenſe whereof it is an inſtrument: now the body of the braine hath not ſenſe and therefore it hath no motion.

Reaſon 1.

Furthermore, if the braine doe breath by a proper power, it would follow that becauſe the ſubſtance thereof is ſoft, and the membrane that compaſſeth the ventricles very fine & thinne, it followeth I ſay, that that membrane muſt in the dilatation & contraction be violently torne aſunder.

Thirdly, the third and fourth ventricles of the brain commonly ſo called, are of the ſame ſubſtance and temper that the vpper ventricles are of; for the vſe of them all is one and the ſame; but it is granted that the latter ventricles doe not Reſpire, and therefore neyther ſhall the former be dilated or contracted.

They vrge further and thinke that this weapon hath a further edge. In grieuous wounds of the head when the braine is vncouered, the motion of the braine and the arteries doeth not appeare to differ at all, but as one Pulſe is anſwerable to another, ſo likewiſe the motion of the braine and the arteries doe accord. Now if the braine did beat by an in-bred power, then muſt it needes be that ſome time the braine and the arteries ſhould not beat alike and at the ſame inſtant.

Finally, there is no Attraction, no Expulſion without the helpe of fibres: ſo the heart hath his fibres, as alſo the ſtomacke, the guttes, the veines and the arteries; but in the brain there appeare no fibres at all; *Ergo* the Motion of the *Diaſtole* and *Syſtole* of the braine is not proper and peculiar vnto his ſubſtance.

Verily theſe reaſons are ſo ſtrong that the time hath bin (ſaith *Laurē.* whē I was cōuinced by them & conſtrayned to ſubſcribe vnto this opinion; but looking ouer with a little more diligence the works of *Galen* and conſidering ſome paſſages in his Booke *de Odoratus Organo, de vſupartium, de Placitis Hippoc. & Platonis* with better deliberation, at length I altered my minde, and am now reſolued that the body of the braine doeth reſpire by a proper faculty and in-bred Motion.

That the braine doth reſpire by it owne force.

Let vs here *Galen* diſputing in expreſſe words in the laſt Chapter of his Book *de Odoratus Organo*, *Nature ſayeth he hath not denyed motion to the braine whereby it might draw Ayre for his refrigeration and returne the ſame backe againe for the expurgation of ſuperfluityes.* Againe in the 4. Chapter of the ſame Booke, *It is not impoſsible that the brayne ſhould yeeld vnto it ſelfe a kinde of Motion (though it be but ſmall) ſometimes into it ſelfe ſometimes out of it ſelfe, ſo that it ſhould be leſſe when it contracteth it ſelfe, and more ſpred when the parts of it are dilated.* Thus farre *Galen.*

The authority of *Galen.*

Reaſon. 1.

But it ſhall behooue vs to eſtabliſh his authority by reaſon alſo and waight of argument. It is moſt certaine that the Animall ſpirit is generated firſt in the vpper ventricles of the braine, which ſpirit being of it owne Nature ayrie and hot, ſtoode neede of the Inſpiration of ayre which was familiar and of kin vnto it, as well for his nouriſhment as that by it it might be refrigerated: wherefore when we draw our breath inward, the ayre alſo is drawne into the braine, and when we breath outward a fumid or ſmoaky vapour which is the excrement of the Animall ſpirit is thruſt out and auoyded.

Hippocrates.

This *Hippocrates* elegantly expreſſed in his Booke *de morbo ſacro* or of the Falling ſickneſſe. *When* (ſayth he) *a man drawes in ayre by his mouth & his noſe is ſhut, firſt of all the breath commeth to the Brayne.* Nowe this Inſpiration of the ayre into the vpper ventricles of the

braine

braine and the Expiration of the ſame is not made by arteries, but by certaine protuberations or ſwelling productions of the braine much like the Nipples of a woman's Pap, which alſo are the Organs of ſmelling. The Motion therefore of the braine which is accompliſhed by Inſpiration and Expiration proceedeth from the braine it ſelfe not from the arteries. Againe, that the ayre is drawne in by theſe productions may thus be proued.

The ayre and odours doe paſſe by one and the ſame way, for no ſmell can be felt although it be driuen violently into the noſe vnleſſe therewith ayre be drawne in: now odors do paſſe into the braine by thoſe productions before named, not by Arteries: and therefore by the ſame productions ayre is inſpirated and tranſported into the foreward ventricles.

Furthermore, if the braine do beate by the Arteries and not by anim-bred power for the generation of ſpirits; why then is not the ſpinall marrow alſo moued? You will ſay haply, that in the marrow of the backe there is not ſo great plenty of Arteries as are found in the braine it ſelfe. I anſwere, it may well be, for there is not the ſame quantity of matter or ſubſtance in the braine and the marrow. But if you compare both bodies together, then will the proportion of the Arteries be as great which runne through the membranes inueſting the marrow. Wherefore the ſpinall marrow is not therefore immoueable becauſe it wanteth arteries, but becauſe in it there is no generation of vitall ſpirits as there is in the Braine. Reaſon 2.

The third argument is on this manner. There is a certaine diſtance betwixt the body of the braine and the *Dura meninx*; not to giue way to the *Syſtole* and *Dyaſtole* of the Arteries, for they are not ſo lifted vp; nor to auoid danger becauſe the *Pia mater* or thin membrane is interpoſed betweene them: the diſtance therefore is left for the motion of the braine, and ſo we ſee that in the heart there is a diſtance betwixt it and the *pericardium*, leaſt if they had touched one another they might haue beene interrupted. Reaſon 3.

Fourthly, how is it poſsible that ſo great a waight and maſſe of moyſture as the braine is, ſhould be dilated by a few ſmall arteries? (for ſo I worthily call them that are ſprinckled through the body of the Braine) ſeeing that the large and notable Arteries of the ſpleene are not able to moue his rare and ſmal body? I anſwere, Anatomy teacheth vs that this bowel is wouen with infinite Arteries, and yet no man euer ſaide that the ſpleene was moued vnleſſe it be in a tumor or inflamation, and then any part will be moued. Reaſon 4.

Fiftly, if the motion of the braine bee the motion of the Arteries and not of the marrowy ſubſtance, then it was ridiculous to ſay that the braine is moued becauſe the Arteries are onely moued. For ſo we might ſay that the ſtomack, the guts and the ſpleene were mooued becauſe the Arteries do beate euery where. And therefore if wee imagine that the marrow of the braine is diſtended by the *Dyaſtole* of the Arteries, why ſhould we not beleeue alſo that all the reſt of the parts of the body do beate, becauſe they haue all proportionably as many Arteries? Reaſon 5.

Finally, the proceſſe called *vermi-formis*, the *Conarion* and the buttocks of the braine do ſhew that there is a peculiar motion of the braine which differeth from the motion of the Arteries. For the wormy proceſſe being made ſhorter, openeth the way which is from the third vnto the fourth ventricle, and whilſt the ſame proceſſe is extended it ſhutteth the paſſage againe leaſt the ſpirit ſhould returne into the vpper ventricles: ſo that it ſeemeth there is the ſame vſe thereof that there is of the values placed at the mouth of the great Artery: now the opening and ſhutting of this cliſt proceedeth not from the Arteries, but from an in-bred power of the braine it ſelfe. It is therefore more probable to thinke with *Galen* that the braine is moued by a naturall motion and that proper to it ſelfe for the nutrition of Animall ſpirits, the tempering of them and their expurgation. Reaſon 6. The Concluſion.

The reaſon and nature of this motion is on this manner. When the braine enlargeth it ſelfe it draweth ayre out of the noſtrils by the mammillary proceſſes and ſpirits out of the Textures or complications of the ſmal Arteries. This ayre and theſe ſpirits it mingleth in that reſt or *interim* which is between the two motions: but when in the *Syſtole* it contracteth it ſelfe the ſides falling together, the inward ventricles are ſtraightned and the Animall ſpirits powred out of the foremoſt into the hinder ventricles. The reaſon of the motion of the braine.

But heere ariſeth a ſcruple of no little moment, which is, whether the ayre is deriued to the braine when it is diſtended or when it is contracted? It ſhould ſeeme that the ayre is drawn in in the conſtriction, becauſe when the brain is contracted it departeth a little from the Scull: the Scul becauſe it is immoueable doth not follow the contraction of the brain. A great queſtion.

It is therefore necessary that there must bee a vacuitie betweene the Braine and the Scull, or else there must be aire drawne in, wherewith that place must be filled.

What wee thinke. But wee thinke that the aire is drawne in in the dilatation of the braine, neither doe we allow that there is any emptie place left in the contraction, because in the contraction there is an expression of aire and fumed vapours through the sutures. Now let vs giue answer to that which is obiected against this our opinion.

The reason of the contrary opinions are answered. They obiected first. That the braine is the beginning of motion, and therefore ought not to be moued. We answer, That indeed it must not be moued with the same Motion wherewith it moueth the parts: It giueth to the parts of the body voluntary Motion, but it selfe is moued with a naturall Motion. The braine is moued after the same manner that it hath sense: Now the sense of it is naturall as is the sense of bones or the bowels, whereby it being prouoked, auoydeth that which is offensiue vnto it, as we may see in sneezing and in the falling sickeneffe. It is moued for the generation of animall spirits.

To the first.

To the second. Their second argument was, that the ventricles of the braine did not respire, because in that perpetuall distension the thin Membrane of the Braine would haue beene broken. But they do not remember that in sneezing and in the Epilepsie, the contraction of the Braine is more violent then in the ordinary Motion; & yet in neither of those is the Membrane broken. In Sternutation or sneezing, the Braine collecteth it selfe and is contracted the better to exclude that which is offensiue vnto it. For the same that the cough is in the chest, and the hickocke in the stomach, the same is sneezing in the Braine. In the Epilepsie the whole Braine is contracted and corrugated.

To the third. Thirdly, they obtrude vnto vs: that the backeward ventricles do not respire, and therfore that the forward ventricles doe not dilate or contract themselues. I answer, first that I know not by what slight or art they can perceiue that the backeward ventricles doe not mooue. But let vs grant that they doe not, yet is their consequence not good; for the formost ventricles doe stand in neede of more, at least of more conspicuous Motion then the other, because in the formost the spirit is prepared and purged, in the backeward they are contained when they are pure, sincere and alreadie purged.

To the fourth Fourthly, the motion of the braine and the arteries doth not appeare to bee vnlike the one vnto the other. I answer, that they are not indeede vnlike, because their vse is the same, there is the same finall cause of the generation of the spirits & of their expurgation.

To the fifth. Fiftly, they doe not thinke it as moued with any proper motion, because there appeare in the braine no *fibres* at all. Wee answer, that the bones doe draw their nourishment, and expell that which is superfluous without the helpe of Fibres.

To the last. Laftly, there is not the same reason or nature of the heart and of the Braine: for the Heart stood neede of Fibres not for the traction and expulsion of aire but of blood. In the *Dyastole* the Heart draweth blood by the right Fibres, and the same blood it expelleth in the *Systole* by the transuerse. But the Braine when it is mooued draweth onely aire with most thinne vitall spirits, for the traction whereof there is no neede of the helpe of Fibres. Hence we thinke it is sufficiently manifest, that the Braine is moued by an in-bred facultie, and not onely by the motion of the arteries.

QVEST. X. *Whether the Braine hath any sense.*

That the brain hath sense. IT is a notable Controuersie amongst Physitians, whether the Brain haue any sense or no. That it hath sense it may bee demonstrated by authoritie, experience and reason. *Hippocrates* in his Booke *De vulneribus capitis*, resolueth that it hath sense where he saith, *That the braine about the sinciput doth soonest and especially feele any inconuenience that is either in the flesh or in the bone.* *Galen* in his booke *De plenitudine*. The Braine (saith he) and the spinall marrow are accounted amongst those things which haue sense. And if in a frensie no paine be felt, it is because the mind is disquieted. Againe in his book *Odoratus organo* he attributeth to the Brain manifest sense. Moreouer experience and sense do confirme the same. *Galen* in the 4. chapter of the aforesaid book, telleth a storie of a certaine man whom hee commanded to snuffe vp into his nose, and to receiue at his mouth *Nigella*, Gith or Pepperwort finely beaten and mingled with old oyle, who thereupon felt a great gnawing in his braine. Which (saith he) is a manifest argument that some of that *Nigella* went into the ventricles of the Brain, and cleauing to the *Pia mater* or thin Membrane, or else haply in the Braine it selfe, was the cause of that paine.

The authority of *Hyppocrates*.

Of *Galen*.

Experience.

Reason.

Againe

Againe, reason seemeth to perswade the same. The Braine is the fountaine and originall of all sense, and therefore it selfe must need be sensible, because by it all other parts haue sense. For it is an axiome in Logicke, *Propter quod vnumquodque est tale, & illud magis tale. That for which any thing is such or such, must needs it selfe be more such or such.* Furthermore, vnlesse the Braine had sense, it could not rouse it selfe vp to the expulsion of that which is offensiue: for in sternutations or sneezings, and fits of the Epilepsie or falling-sicknes, how should the Braine bee moued and shaken to exclude and auoyde the humour or vapour by which it is vellicated or goaded vnlesse it felt the affluence thereof?

Contrarily, the opinion of those who determine that the Braine hath no sense, may also be confirmed by authoritie, experience and reason. *Aristotle* in the 17. chapter of his 3 booke *De historia Animalium*; And in the 7. capter of his second booke *de partibus Animal.* writeth, that the Braine and the marrow haue not *sensum tactus* the sense of feeling. *Galen* in the 8. chapter of his first book *De causis sympto.* The Braine (saith he) was ordained by nature, not to haue sense but to communicate the faculty of sensation to the instruments of the senses. In his third booke *De causis sympt* hee calleth the Braine an Organe without sense. The contrary opinion.

Experience, then which nothing is more certain, conuinceth the truth of this position. For when the Braine is wounded the patient doth not feele although the substance therof be pressed with a sharpe probe, no not if some of it be taken away, which thing is very ordinary for Physitians and Chyrurgions to obserue. Experience.

Finally, it may be demonstrated by reasons. Euery Organ (saith the Philosopher) must be ἄποιον that is, *without any externall quality.* So in the Christaline humor of the eye there is no colour, in the eare no sound, in the tongue no sauour; and the skin which is the Iudge of those qualities which mooue the sense of touching is it selfe of a moderate temper. So the braine is the seate of the common sense and iudgeth of all sensation, and therefore must it selfe be without sense. Reasons.

Moreouer, the braine ought not to be sensible, for if it were hauing his scituation vppermost and like a cupping glasse drawing and supping vppe the exhalations of the lower parts it would by their affluence perpetually be payned.

Finally, the substance well nigh of all the bowels is insensible, as of the liuer the spleene, the lungs, &c. and therefore the substance also of the braine is insensible.

To this opinion we rather subscribe then to the former, following therein *Galen* in his first booke *de causis Symp.* where he is not of opinion that the braine hath sense, but onely that it can discerne the differences of sensible things.

Those things which are brought to proue the contrary affertion, seeme to me now to be very light. *Hippocrates* sayde that *the braine did feele those iniuries that were in the flesh and in the bone*, that is to say, it is affected and altered by them. So the same *Hippocrates* saith in his Aphorismes that the bones do feele the power of cold, that is, they are altered by cold. Wherefore he vseth the word Sense in that place abusiuely. *Galen* attributeth sense to the braine. It is true, yet not to his marrowy substance which is the fountaine and originall of all the Animall faculties, but to the *Pia mater* or thin membrane which insinuateth it selfe deepely into the corners thereof. As for that logicall Axiome, it is only true in these causes which we call Homogeny, and those also conioyned. For the Sunne being of it selfe not hot yet heateth all sublunary things. And whereas they say that the brain is shaken in the exclusion of that which is hurtfull, and thence would proove that it is sensible; wee answere, that there is seated in euery particular part a naturall power to expell that which is hurtfull; which power is sometime ioyned with Animall sense, sometimes also it is without the same. So the bones haue a power of excretion, and the flesh almost of all the bowels being insensible, is yet apprehensiue of those things that are hurtful, yea expell them also and driue them forth. There are in the nature of things certaine *Sympathies* and *Antipathies*. Answere to the arguments of the former opinion. How the braine apprehend that which is hurtfull.

Fernelius in the tenth Chapter of the 5. booke of his *Physiologia* hath diuised a new and vncouth opinion concerning the motion and sense of the braine. He conceiueth that all motion is from the marrow of the braine, and all sense (saith hee) floweth from the Meninges or Membranes: because the body of the braine is perpetually mooued, & yet hath no sense at all; on the other side the membranes that incompasse it are of themselues immoueable, especially the *Dura mater*, and yet their sense is most exquisite. So in the diseases which we call *Dilirium*, that is, an aberration of the minde and in the Letargy which *Fernelius.* new opinion.

are

are affects of the Braine there is no paine at all: but if a ſharpe humor or vapour be tranſported into the Membranes, then is the patient as it were on the racke.

Furthermore, the ſpine and all the nerues haue their marrow from the braine and the ſame inueſted with membranes: al which haue the ſame power and nature which they receiued from their originall. Therefore the fore-part of the braine is the originall of ſenſe, the backepart the beginning of motion and the menings or membranes are the beginning of *touching*. Thoſe nerues that are fulleſt of marrow are the inſtruments of motion, but thoſe are the inſtruments of touching which are for the moſt part derined from the meninges.

Fernelius his first error.

Theſe are *Fernelius* words, wherein, ſaith my Author, by the fauor of ſo great a man, I finde ſome things that cannot be warranted. Firſt he ſaith that all voluntarie motion floweth from the Marrow becauſe the Marrow is perpetually mooued, as if the motion of the Braine and of the Nerues and Muſcles were alike. The motion of the Braine is Naturall conſiſting of a *Dyaſtole*, a double reſt and a *Syſtole* for the generation of Animall ſpirits, but the motion of the Muſcles and the Nerues is voluntary.

Second.

Furthermore, we are not to thinke that the Nerues are ſo much the fitter for motion by how much they haue more marrow; rather we beleeue the contrary, that the harder Nerues are fitter for motion and the ſofter for ſenſe, becauſe ſenſation is a paſsion but motion an action; we know alſo by experience that the Opticke Nerue which is the ſofteſt of all the Nerues hath more Marrowy ſubſtance then the Nerue of the ſeconde Coniugation, yet the Opticke is the Nerue of Senſe, the other the nerue of Motion.

Add heereto, that Motion ſhould bee rather aſcribed to the Membranes then to the Marrow, becauſe the Marrow melteth away but the Membrane is ſtretched & contracted: ſo the Nerues of children are weake and ſoft and vnfit for motion. To all theſe

The authority of *Galen*.

let vs add the authority of *Galen* in the third chapter of his ſeuenth Book *de Placitis Hip. & Platonis*, where he ſaith, that the faculties of Motion and Senſe are only conteined in the Marrow of the Braine and that the Membranes were made to cloath and noriſh the Marrow & for no other vſe.

The Braine hath neyther ſenſe nor motion, and yet is the original of both.

We conceiue therefore that this Paradox although it be witty, yet will not holde at the Touchſtone, and therefore we determine that the Marrow of the Braine is without all ſenſe and Animall motion, and yet is the fountaine and originall of all Animall Senſe and motion. Of Senſe, becauſe it perceyueth the repreſentations and receyueth the impreſsions of all ſenſible things. Of Motion, becauſe it diſpenſeth and affoordeth al that power and command for the auoyding of that which is noxious, and proſecution of that which is profitable; from whence it commeth to paſſe that when the Braine is il affected the inferior parts haue neither Senſe nor Motion.

QVEST. XI. *Of the Temperament of the Braine.*

THE Phyſitians and the *Peripatetikes* in this do agree, that the brain in the Actiue qualities is cold, in the Paſsiue moyſt. But heerein they differ, that *Ariſtotle* in the ſeuenth Chapter of his ſecond booke *De partib. Animalium* and in the fift Chapter of his booke *De Somno & Vigilia*, determines that the braine is actually cold and ordained to refrigerate or coole the heart. Contrariwiſe, the Phyſitians ſay that it is Actually hot. For *Galen* in his eight booke *De*

Reconciliatiõ of *Ariſtotle and Galen*.

Placitis Hip. & Platonis ſaith, that the brain is hotter then the moſt ſoultry aer in ſummer. Some there are that do thus reconcile *Galen* and *Ariſtotle*; There is (ſay they) a double temperament of the braine, the one In-bred, the other Influent: by the In-bred temper, the proper compoſition and the marrowy ſubſtance, the braine is very cold; but by the influent temper it is hot, for it is full of ſpirits and intertexed with very many ſmall Arteries.

If you reſpect the in-bred temper, then is the temperament of the braine and the ſpinall marrow one and the ſame, becauſe they haue the ſame marrowy ſubſtance. If you reſpect the Influent temper, then ſaith *Galen* in the ninthe chapter of his ſecond booke *De Temperam.* the braine is hotter then the ſpinall marrow, as well becauſe there paſſe vnto it more Arteries, as alſo becauſe many fumid exhalations do aſcend vnto it. Some ſay, that the braine is ſimply and abſolutely hot; but colde comparatiuely, becauſe it is the coldeſt of all the bowels. And *Galen in Arte medica* writeth, That a hot braine is colder then the coldeſt heart. In which reſpect *Hippocrates* in his booke *de Glandulis* calleth

the

the braine μιλρέσωλιν τὸ ψυχρὸ *the Seate of Coldnesse.* But I cannot approue this opinion. For if the brain be colder then the skinne which is in a meane betwixt the extremes, then it is simply cold and not hot. Now that it is colder then the skin *Galen* teacheth in his second booke *de Temperamentis.*

It will be obiected, that if the braine be laide bare it will presently be refrigerated by the aer, whereas the skin is not affected therewith. I answer, that the braine is altered by the aer, because it is not accustomed thereto as the skinne is; so the Teeth beecause they are accustomed to the aire do not grow blacke as other bones do if they bee layde bare. Or againe, that the braine is hotter to feele to then the skin, because it is couered with the scull and the membrane and hath many complications of the arteries therin. We determine therefore that the Braine of his in-bred temper is colder then the skin, but by his influent temper is hotter. That the Braine should be colde it was very necessary least a Member set a part for continuall cogitation or discourse should bee enflamed and set on fire. Againe, that the animall spirits which are very fine and subtill might be retained and not vanish away.

Obiection. Solution. Why the braine ought to be cold.

Finally, that our Motions and Sensations should not be rash or phanaticall as they are in such as are phreneticall, that is, haue their braines inflamed. It may be obiected, if the Braine be cold, how then doth it ingender animal and attenuate vitall spirits; for these are the workes of a vehement heate? I answer, that the spirits are attenuated in the textures of the small arteries, & in the strayghtes of those passages: & that the animall spirit is formed not so much by any manifest qualitie such as is heate, as by an in-bred and hidden proprietie.

Obiection. Solution.

But the reason why the spirits of the extreame hote Heart are thicker then those of the very cold Braine must not be referred to the weaknes of the heate which is the worker, but to the disposition of the matter which is the sufferer. For the heart maketh vitall spirits of of thicke blood brought vnto it through the hollow veine: the Braine maketh Animall spirits of subtill and thin vital blood and spirits: so a weaker heate boyleth a thin and easily concocted aliment, whereas a very strong heate will hardly ouercome a thicke aliment. It remaineth therefore that in the actiue qualities the braine is cold.

Why the spirits of the extreame hot heart are thicker then the Animall spirits.

That in the passiue qualities it is moist both by the in-bred and influent temper no man I thinke is vnresolued: for it appeareth euen to the touch. Now it was by nature created moist, as well for more perfect sensation, (for sensation is a passion; and those things that are moyst do more easily receiue the images and representations of things offered vnto them) as also for the originall and propagation of the nerues which would not haue beene so flexible if the braine had beene hard. Adde heereto that if the braine had beene hard it had also beene heauy and the waight and hardnesse thereof would haue bin offensiue to the sinewes.

Why the braine was made moist.

Finally, it was made moist least being a member destined to perpetuall motion sensation and cogitation it should haue beene inflamed if the moysture had not bin an impediment thereto. But if you compare the two qualities together, then we say that the braine is more moist then cold: for amongst the moist parts it hath a third place, among the cold parts almost the last.

QVEST. XII. *How many and what are the Excrements of the Braine, and by what wayes they are purged.*

THE Braine being of a medullous or marrowy substance and by his naturall temper colde and moist because it is nourished with flegmaticke blood, heapeth together a great aboundance of excrements.

Why the brain aboundeth with excrements.

Moreouer, being as it were the Chimney of the whole body, or the head of a Still (whose figure also it representeth) it sucketh and draweth from the lower parts all kindes of expirations as *Hippocrates* teacheth in his booke *de Glandulis* wherevpon it beecommeth filled with vapors and as it were drunke with their continuall affluence and so stableth in it selfe a masse of superfluity; so that it aboundeth with excrements as well of it selfe, that is, it of own nature because it is cold & moist, as also by euent for that it is seated in the vppermost place whether all vapors do resort.

These

Thicke. Thinne.

These excrements of the braine, if wee beleeue *Hippocrates* and *Galen* are of two sorts, some are thinne and some are thicke; the thinne like vapour or foote do expire or exhale vpward by insensible passages; the thicke are purged downeward by open and conspicuous wayes. VVith the thinne and vaporous exhalations the braine is cloyed onely by reason of his scituation, for all fumes doe arise vpward; and beside all vessels doe determine in the head. But it aboundeth with these crasse and thicke excrements aboue other bowelles by reason of the cold and moyst temper thereof.

The kinds of thick excrements.

Of these thicke excrements some are phlegmaticke, watrish and serous; some are bilious, some melancholy. The watrish is generated of the reliques of the phlegmatick and crude bloud: the bilious or melancholly out of the earthy portion of the Aliment torrified by the violence of heate, and therefore they grow bitter.

Argenterius his error concerning the fleg matick excrements of the braine.

Argenterius is of opinion that that watrish and mucous humour which is auoyded partly by the nose partly by the mouth and pallat, is not the proper excrement of the brayne, because many men and women doe seldome or neuer spit, and as seldome auoyd any moisture by the nose; but sayth it is a humour ingendred in the liuer mixed with the bloud and contained in the veines, which is not generated in the braine vppon the concoction of the Aliment, but is thither deriued from below: and because through the weaknes of the concoction and cold distemper it cannot be assimilated by the braine, it returneth back again as a redundance or superfluitie and is cast out by the mouth & by the nose. VVhich assertion of his if it were true, what reason had nature to place in the saddle or seat of the wedge-bone that kernelly and spongie flesh? was it not appoynted to receiue this very excrement? If this phlegmaticke humor were onely generated in an intemperate braine, what vse were there of the glandule which is found in all braines though most temperate? Nature is too wise and prouident so rashly to frame any part where there shal not be continuall vse thereof. In this opinon therefore of *Argenterius* wee can finde no vse either for the *Tunnell or the phlegmaticke Gandule* if the braine be not distempered. Moreouer, it is not true that he sayeth, that those whose braines are temperate doe not spit phlegme or auoyde mucous matter by their nose: for *Galen* in the 13. Chap. *Artis parue* teacheth, that in a brain which is most temperate the excrements that are purged by the nose and by the pallate (such as are watrish and mucous excrements) are in moderate quantity: neither are we to attribute it vnto perfect sanity when we finde those excrements by the passages not to bee auoyded. VVherefore we conclude against *Argenterius* that these phlegmatick and mucous humors are the proper excrements of the braine, because in the braine they haue peculiar conueyances and channels by which they are auoyded, framed by Nature onely for their euacuation.

Confuted.

Hauing thus determined concerning the differences of the excrements of the braine, let vs now see by what passages euery of these excrements are auoyded.

By what waies the thin excrements breath out.

The thin and fuliginous excrements arising vpward because of their leuitie, doe expire or breath out through the Meninges, the Skull and the Skin. Through the Meninges and the Skinne not by any sensible or conspicuous way but by insensible exhalation; for their bodies while a man is aliue are infinitely perforated or at least peruious with many small holes. But these sooty vapours because they could not passe the thicknes and density of the bones, therefore is the Skull distinguished with sutures or seames, so that it consisteth not of one bone but of diuers ioyned together by those sutures, through which as also through the holes which are thrilled betwixt the tables of the Skull these thin excrements and fuliginous vapors do exhale.

The waies of the thick excrements.

But the thicker excrements descending downeward by their Naturall and Elementary forme, haue manifest and conspicuons passages, concerning which Physitions doe not so perfectly agree among themselues; *Hippocrates* in his Booke *de locis in homine & de glandulis*, acknowledgeth seauen wayes by which the humour passeth out of the braine, that is, through the nose, the eares, the eies, the pallat, into the throat & gullet through the veins, into the spinall marrow and into the bloud.

Hippocrater.

Galen.

Galen in his 13. Chapter *Artis parua*, saith there are foure passages, the pallat, the nose, the eares and the eies. The same also he saith in the third Chapter of his second Book *de locis affectis*, and in his first Booke *de sanitate tuenda*: but in his Commentary vpon the 21. Aphorisme of the first Section, hee nameth onely the pallate and the nose, as also in the first Chapter of his 9. Booke *de vsu partium*, where hee sayth, the passages of the braine which bend downward doe send out the thicke excrements as well by the pallate into the mouth

mouth, as alſo by the body of the Noſethrils; and theſe paſſages are large and conſpicuous. In his firſt booke *de ſymp. Cauſis* and the 8 *de vſu partium* he ſaith, that the pallate alone is the fit way of expurgation when the creature hath good concoction, and that the noſethrils do onely ſerue for the inſpiration of aer and odours.

In his Commentary vpon the 24. Aphoriſme of the third Section he writeth; That the expurgation which is made by the eares is not naturall vnleſſe it be in litle children by whoſe eares we often obſerue that their braines are purged.

In his Commentary vpon the 20. Prognoſt. of the firſt Section he ſaith, that the expurgation by the eyes is not naturall. Thus *Galen* ſeemeth to be of a diuers opinion concerning theſe paſſages of the braines excrements. But that we may reconcile theſe different places and freely profeſſe what truly we are to reſolue of; wee thinke that the diuers excrements of the braine, Phlegmaticke, bilious and melancholicke are purged by diuers wayes, ſome of which are ordinary, familiar and accuſtomed to Nature; others extraordinary and not ſo conuenient. Places in *Galē* reconciled.

The ordinary paſſages prepared for the expurgation of Flegme are the pallate and the noſethrils; but the palate eſpecially, becauſe the Noſtrils were primarily appointed for ſmelling. Anatomy teaches vs that out of the third Ventricle of the Braine there is a conſpicuous paſſage to the inward baſis thereof, in whoſe extremity there appeareth a ſmall portion of the thin Membrane which is firſt broader then groweth narrower like a Tunnell which the Grecians call πυελὸν ἢ κοάνην. The Latines *Peluis* and *infundibulum*; *The Baſon or Tunnell*, through which the Flegmatick humor is by litle and little tranſcolated as it were through an *Hyppocras* bagge. This wateriſh humor is receiued by a flegmaticke Glandule like a ſponge, and afterward diſtilleth by degrees through the holes of the Wedge-bone into the pallat and mouth. But if at any time (which is not vnvſuall) the vpper Ventricles of the Braine grow full of a mucous ſlime it droppeth through the proceſſes which are like to the nipples of a womans paps into the *Os Cribri forme*, or ſpongy bone, and ſo into the Noſethrils. Some paſſages ordinarie, ſome extraordinary. The waies of the Phlegme.

The bilious excrements are continually purged by the ears. Some ſay that therefore the bilious excrements are throwne out by the eares that the heate and ſiccitie thereof might keepe the bones of the eares dry and ſo more fit to receiue and report the ſound. But the Phlegmatick excrements are purged by the mouth and noſethrils, that thoſe open paſſages by that humidity might be kept from drying vp. Theſe therefore are the ordinary channels and moſt familiar to nature by which ſhe purgeth the excrements of the Brain? There are alſo other extraordinarie waies by which the brain oppreſſed or ſurcharged with abundance of humor exonerateth it ſelf. Such are the eyes, the Spinal Marrow and the Nerues from whence commeth the Palſie. There is alſo ſometime a fall of humors through the Veines and arteries into the *Parotidas* that is the Glandules behinde the eares. But theſe are not the peculiar excrements of the brain, that is, of the Marrowy ſubſtance and of the Ventricles, but rather of the veſſels as Veines and Arteries from whence proceed tumors of the glandules, inflammations likewiſe of the eyes and of the eares. The Bilious by the eares. The extraordinary paſſages.

Now theſe excrements in a temperate Braine are moderate in their ſubſtance, quantity, quality & time of excretion. In the ſubſtance, becauſe they are neither to thick nor to fluid; in their quantity becauſe they do not abound; in their quality becauſe they are neither ſalt nor ſharpe; in the time of excretion when they are auoyded after concoction.

The remaineth one ſcruple to bee reſolued, that is, by what wayes the ſuperfluities of the *Cerebellum* and of the fourth ventricle are purged. We ſay for anſwer that the excrements of the *Cerebellum* and of the fourth ventricle are very fewe, as well becauſe of the hardneſſe of the *Cerebellum*, as alſo beecauſe in the fourth ventricle are contained moſt ſubtle, pure and well purged ſpirits, and therefore thoſe few ſuperfluities are eaſily diſſipated. But the braine it ſelfe being in quantity very great and of temper very moyſte heapeth vp aboundance of ſuperfluities which ſtand in neede of conſpicuous paſſages by which they ſhould be auoyded. By what paſſages the ſuperfluities of the afterbrain & the fourth ventricle are auoided.

QVEST.

QVEST. XIII. *Of the number and vse of the Ventricles.*

Of the number of the ventricles.

IN the Hiſtory of the Ventricles of the braine there are many things controuerted which offer themſelues to our conſideration; and firſt of all the Anatomiſts doe differ concerning their number. *Galen* determineth that there are foure, two *ſuperior* which he calleth *anterior ventricles*; the middle which is a common cauity and the backward. *Auicen* numbreth but three; the vpper, the middle and the hindmoſt; eſteeming the vpper two for one, becauſe they haue the ſame figure, magnitude, ſcite, ſtructure and vſe. *Arantius* addeth two others vnder theſe which he nameth from the figure *Hippochampi*, but I thinke that they are parts of the vpper ventricles, which indeed are ſo large that in common diſſections ſcarſe their third part is ſhewne. *Varolius* cutting the braine after a newe manner ſayth there are but two; but becauſe we haue at large made mention of his opinion in the Hiſtory foregoing, we will not here weary our Reader with itteration thereof, but referre him thither for further ſatisfaction.

Of the vſe of the ventricles

Concerning the vſe of the ventricles, *Veſalius* taxeth *Galen* about the vſe of the vppermoſt two; becauſe hee ſayth that they are the organs of ſmelling and that out of theſe by certain proceſſes the phlegme is trãſcolated into the ſpongie bones. VVe anſwere for *Galen*, that the *anterior* ventricles are therfore called the Organs of ſmelling, becauſe vnto the are odours brought of which alſo they iudge. Beſide, what ſhould hinder that the flegme (if the brain abound therewith) ſhould not be tranſported from them by thoſe proceſſes into the ſpongie bones, ſeeing we find that ſomtimes (as in the *Apoplexie*) the phlegme is diffuſed through the whole body of the braine; and ſometimes falleth into the nerues and the ſpinall marrow as in the Palſie? It will bee obiected that the ſence of ſmelling would be extinguiſhed if the phlegme ſhould bee tranſcolated by theſe proceſſes: I anſwere, that ſometimes when the Fluxe is continuall and the humour very aboundant the ſmelling is loſt, not ſo much by reaſon of the obſtruction of the proceſſes, as becauſe the holes of the bone are intercluded.

Galen redeemed.

Obiection.

Solution.

The opinion of ſome new writers.

Some new writers there are who thinke that the *anterior* ventricles were not appoynted for the preparation and concoction of the ſpirits, as well becauſe they are the receptacles of excrements, as alſo becauſe the Animal ſpirits did not ſtand in neede of any ſenſible cauity. But *Galen* anſwereth, that Nature hath prepared them to ſerue both turnes; like as through the ſpongie bone odours doe aſcend and ſuperfluities or excrements deſcend. As therefore thoſe things which are auoyded euery day by the pallat and the noſthrils do neyther hinder the Taſte nor the Smell if they bee moderate: ſo it is in the excrements of the braine.

QVEST. XIIII. *Which of the ventricles are moſt excellent.*

Of the prehe-minence of the ventricles of the braine.

COncerning the excellency or *ſuperiority* of the ventricles of the brain ſome different places in *Galen* are to be reconciled. It is commonly receiued that among all the partes of the braine the ventricles are moſt excellent, not becauſe they are particular ſeates of the Principall faculties, but becauſe in them the Animall ſpirits are generated. That teacheth *Galen* in the third Chapter of his 7. Booke *de Placitis Hip: & Plato*. If, ſayth he, you cut the braine any way the creature will not looſe ſence and motion before the wound pierce vnto ſome of the ventricle. But whereas there are foure ventricles it may be demanded which of them is moſt noble.

The vpper ventricles are the baſeſt.

Galen teacheth that the vpper ventricles are the baſeſt; In his 8. Booke *de vſu partium &* the 10. Chapter. In his 7. *de placitis*; and in his Commentary vppon the 18. Aphoriſme of the ſeuenth Section, by the example of a young man of *Smyrna* a Citty of *Ionia*, who being wounded into one of the vpper ventricles yet eſcaped with life. Concerning the third and fourth ventricles *Galen* ſeemeth to differ from himſelfe; for in the fift Chapter of his third Booke *de locis affectis* he yeeldeth the prerogatiue to the fourth ventricle. The Animall ſpirit ſayth he, is contayned in the ventricles of the braine, eſpecially in the hindermoſt, although the middlemoſt is not to be contemned: which is as much as if hee had ſayed the middlemoſt is not the nobleſt. For wee are perſwaded by many reaſons to eſteeme this aboue the two vpper. In the third Chapter of his 7. Book *de placitis*; A wound in the hindmoſt ventricle doth moſt of all offend the creature; In the ſecond place the wound of the middle ventricle; but leaſt of all if it be in the two vpper: the ſame thing may bee ſayed of

The 4. the nobleſt.

According to *Galen*.

ſec-

sections or bruises of the head. And these authorities of *Galen* are seconded by reason; for it is a perpetuall truth in the body of a man, that by how much the cauity is greater, by so much it is the baser. The fourth ventricle is of all the rest the least and the narrowest, and containeth the Animall spirit sincere defœcated and exquisitely purged: the other do onely prepare the spirit, and therefore the hindmost ventricle is the most noble.

Yet *Galen* in many places seemeth to say the contrary, as for instance in the 7 chapter of his third booke *de locis affectis*, and in the second chapter of his fourth booke, he preferreth the third ventricle. If saith he, at any time the whole fore-part of the braine bee affected, those things which concerne the vpper ventricle are drawne into consent, and the action of discourse is vitiated; where, by the vpper ventricle he vnderstandeth the third or the middle: but why, I am not able to giue a reason. But if discourse bee seated in the middle ventricle, then is it the most noble. In the last chapter of his third booke *de placitis* expounding the fable which faineth Minerua to be borne out of the toppe of *Iupiters* head. Therfore, sayth he, they faigne her to be borne out of the top, because there vnder is seated the middle ventricle which is the principall of the braine and the originall of wisedome.

Galen seemeth to say the contrary.

Moreouer the wonderfull structure of the third ventricle is an euident argument of the excellency thereof, as also because the wounds of the *Occipitium* are lesse dangerous then those of the *Sinciput* or fore-part of the head. So saith *Hippocrates* in his booke *de vulneribus capitis. More escape death that are wounded in the hinder parts of their heads then in the fore-part.*

The reason.

You shall reconcile *Galen* if you say, that when he auoucheth the fourth ventricle to be the most noble, then he speaketh according to his owne iudgement: but when he preferreth the third he speaketh according to the opinion of other men, especically of *Herophylus*. For *Galen* did not attribute or assigne to the principall faculties particular mansions or habitations in the braine as we haue heeretofore prooued.

Galen reconciled.

Againe, vpon a wound in the *Occipitium* or nowle of the head, the fourth ventricle is sildome offended, because there is much flesh and the thickness and hardness of the bone to resist the violence of the blow, whereas the bones of the *Sinciput* or fore-part are much more slender and weake.

In the whole history of the head I do not finde that *Galen* seemeth so much to wander out of the way as in the description of the *Rete mirabile* or *wonderfull Net*, for this in a man is so small that a good eye can hardly discerne it. I like rather, saith my Author, to call the *Plexus Choroides* (which is manifest and obuious to euery eye in the vpper ventricles of the braine) *Rete mirabile* or the *Wonderfull Net*, as also some of the new Writers haue done: for in it the vitall spirit is attenuated and the Animall getteth a certaine rudiment. And thus are we come to an end of the Controuersies concerning the Braine especially the substance thereof. Now let vs proceed to the second part of the head which is called the Face and so to the Senses.

The error of *Galen* in the wonderfull Net.

Zz

The End of the seauenth Booke vvith the Controuersies thereto belonging.

THE EIGHTH BOOKE,

Of the Senſes and their Inſtruments, *as alſo of the Voyce.*

The Præface,

ALthough in the former Booke wee have made mention of the Inſtruments of the Senſes when we deſcribed the Coniugations of the Sinnewes of the Brain, yet becauſe there are many other parts in the Head ſet apart for their vſe, wherein the glorious wiſedome of our Creator dooth moſt manifeſtly ſhine and in the preſeruation whereof wee are deepely intereſſed, I haue thought good to appropriate this Eight Booke vnto the Hiſtory of the Senſes. Now in euery Senſe there is a Matter and a Forme. The Forme is the Faculty which is a thing yſſuing from the Soule and differing in Name not in Nature as it informeth this or that Matter which is the Inſtrument. The

The eyes.

firſt of the Senſes is the Eye the moſt precious part of the body; and they are two, that if one ſhould miſcarry the other might ſupply the neceſsity of Nature. They are ſet like Centinels or Scout-watches in the top of the Towre, whence they may diſcerne the farther off if any thing approach either hurtfull or behoouefull that we may apply our ſelues to it or auoyde it.

Galen is of opinion that the Head was placed vppermoſt in the bodie for the Eyes ſake, becauſe the Opticke Nerues ſtood in neede to bee very ſhort. For their ſecurity they are ſcituated in Caues and fenced about with diuers Muniments. Aboue them hang a round arched brow to beare off and caſt ouer what might fall from the Head, and betwixt them runnes the Noſe as a ſtrong wal, vnder them the bones of the Cheeke ſtand out, and at their ſide the hard bones of the Temples.

They are immediately couered with ſoft lids that they might not impeach the delicacy of the inſtrument; the vppermoſt are mooueable and verie nimble which do ſhut vp the pupils as well in reſt to refreſh them, as alſo when any outward iniury is ready to annoie them; the lowermoſt are immooueable or at leaſt mooued, inſenſibly. Theſe liddes are againe bearded with haires whereby and wherein ſmall bodies or Motes which happly in their approach are not diſcerned might be intercepted.

The Eyes themſelues haue many Muſcles allowed them whereby they are mooued euery way, vpward and downward, to the right and to the lefte and round: they are alſo by a Muſcle ſuſteined and kept ſtable or firmed whereby the ſenſe is more certaine. Diuers Coats they haue wherewith they are couered, the firſt called *Adnata*, the ſecond *Cornea*, the third *Vuea*, the fourth *Aranea*. There are alſo three Humours, the firſt *Watery*, the ſecond *Glaſſy* and the third *Chriſtalline* which is the chiefe Organe of the ſight, and is aſſiſted by the other parts aboue mentioned. The eye indeede ſeeth with the Chriſtalline humor, but it ſeeth perfectly and more accompliſhedlye with the whole Organ or Inſtrument.

mẽt. The obiect of this ſenſe are thoſe colors which are in the ſuperficies of other bodies.

Next followeth the Eare, the Inſtrument whereby the Soule diſcerneth of all manner of ſounds and voyces. The chiefe part of this Organ is a thin and ſubtle aire bredde in the eare and ſeated within the cauity therof; to which aire the ends of the Nerues of hearing which come from the Braine doe attaine: and as the Opticke Nerue encompaſſeth the Criſtalline humour, ſo this nerue of Hearing is thought to encompaſſe the *In-bred Ayre* and ſpirit, and ſo the ſociety growes betweene the inſtrument of the Senſe and the inward principle of Senſation. Before this Aire is a Membrane ſtretched which we cal the *Drum* ſupported and eſtabliſhed with three Bones, the ſmalleſt of the whole body, but none formed with more curious Art; the firſt is called the *Hammer*, the ſecond the *Anuile*, the third the *Stirrop*. Many men haue laboured to aſsigne to each of theſe their proper vſes and how they conferre to the ſenſe of Hearing, but truth to ſay, their diſcourſes do rather feed then fill the minds of their Readers. The Eares.

God hath reſerued many ſecrets in mans body to himſelfe, whereof wee iuſtlie thinke this is one; yet we know that they ſuſtaine the Membrane of the Tympane agaynſt which the repreſentation of the ſound or voice is beaten and communicated to the inbred Aire. Theſe ſounds are admitted to the Inſtrumẽt by the hole of hearing, a hard & dry entrance full of embowed Meanders and Convolutions, leſt the outward aer falling or ruſhing ſuddenly vpon the *Drum* ſhould endanger the breaking therof. Without the Eare there ſtandeth a griſtly ſubſtance which partly defendeth the hole of Hearing that nothing fall into it, partly catcheth and ſtaieth the ſound that it paſſe not by.

The third Senſe is that of Smelling, whoſe Inſtrument doth not yſſue out of the Scull in thoſe creatures which do reſpire, but is conteined within the ſubſtance of the brain: whẽce it followeth that theſe 5. are called outward ſenſes, not ſo much becauſe they appear outwardly, but rather becauſe their proper organs doe receiue the ſpecies or repreſentations of outward things. The inſtrument therefore of ſmelling is a paire of productions iſſuing out of the forward Ventricles of the Braine, in which the faculty of ſmelling reſiding doeth comprehend the odors of things which together with the aer are drawne in thorough the paſſages of the noſe, which is rayſed higher in the face of a man then of other creatures, as well for beauty, as becauſe the Braine of a man being large and therfore yeelding, abundance of excrements might ther-through be better clenſed. This noſe is diuided in the middeſt by a griſtly ſubſtance, aſwell to breake and diuide the outward aire which in a great part is drawn in this way to be conueyed into the ſharp arteries & ſo to the lungs; as alſo to diſperſe the parts of the obiect of this ſenſe, that being ſo diuided it might equally inſinuate it ſelfe through the ſmall holes of the ſpongy bone to both the productions which determine on either ſide. The Noſe.

The fourth Senſe is the Taſt, the Forme whereof is ſeated in thoſe Nerues which attaine vnto the tongue and pallat aſsiſted by the ſpongy fleſh of the tongue it ſelfe. For when any ſauoury quality or affection imparted to a humor or iuice is applyed vnto the tongue; it ſtirreth vp the taſte, and preſently the image or ſpecies of that ſauour is by the ſpirit reſiding in the Nerues conueied to the principall Senſator; and if it happen that the ſauour be repreſented to the Inſtrument in a hard or congealed body as ſalt, pepper or ſuch like, it cannot mooue the ſenſe before it be melted by the heate, or at leaſt haue communicated his affection vnto the moiſture of the mouth, and therfore it is that nothing can affect the taſte which cannot be diſſolued, neither is he whoſe tongue is torrified or parched with extraordinary heate a competent iudge of ſauors or Taſts. The Tongue.

As for the Touch which is the fift and laſt ſenſe; it is not conteined within any proper organ or inſtrument but equally diffuſed through the whole body, becauſe the neceſsity of Nature did euery where require the preſence thereof for the ſecurity of the life of the creature; and yet notwithſtanding it dooth not (as other ſenſes) receiue the impreſsion of all his owne proper obiects. For ſenſation is a paſsion: if therefore the Obiect bee of the ſame temper with the Inſtrument, the ſenſe is not affected therewith, becauſe it doth not ſuffer by that which is like vnto it; but all the other ſenſes do apprehend all thoſe qualities which do fall vnder them; for being all vnlike to the inſtruments they muſt needs be affected by them. But becauſe this ſenſe hath no particular inſtrument in the head, we ſhall only intreate of it by the way in this place; ſomwhat we haue ſpoken of it before in our diſcourſe of the skin, and more we ſhal haue occaſion to ſay in the booke of the Ioynts and the Veſſels. Wherefore we deſcend vnto our Hiſtory. The ſenſe of Touching.

CHAP. I. *Of the other part of the head which is called the Face, together with the veſſels and muſcles thereof.*

HAuing gone through that part of the Head which is couered with a hairy ſcalfe and therefore by *Ariſtotle* in the 7 chapter of his 1. book *de hiſtoria Animalium* called τειχωλὸν; it remaineth that we proceed vnto the other part which is without hayre called in man πρόσωπον; which name it ſeemeth to haue receiued from the thing it ſelfe, ſaith the Philoſopher in the firſt chapter of his third book *de partibus Animalium*, becauſe a man πρόσωθεν ὁπωπε, that is, *looketh forward*; for of all creatures onely man goeth vpright and looketh directly forward. The *Latines* call it *Facies*, in the comely conformation and Beauty whereof the elegancy of the humane nature doth moſt appeare. It is alſo called *Vultus a voluntatis iudicio*, becauſe it bewraieth the diſpoſition of the will, and is eſpecially changed according to the variety thereof. We call it the Face or the countenance.

The names of the face.

The parts of the face.

The parts therefore of the Face are two: the vpper is properly called μέτωπον *Frons a ferendo*, becauſe it beareth in it the Paſsions of the minde, wee call it the Forehead whoſe loweſt parts are the eye browes. The ſecond and lower part of the Face beginneth at the eye-browes and reacheth to the bottome of the Chinne, in which there are many parts. Both theſe parts of the face haue alſo ſome parts conteining & ſome conteined. The containing parts are common or proper: common as the cuticle or ſcarfe-skin & the skin it ſelfe; which in this face, in the fingers ends, in the Yarde and the Cod is moſt thin. This skin in the Cheekes for the moſt part looketh red becauſe of the affluence of blood from the vtter branch of the externall Iugular veine; which is diſſeminated betwixt it and the fleſhy membrane. This skin is furniſhed with hayres; about the eyes for their ſecurity; about the mouth in men as an argument of their virility and a peculiar beauty of that ſex; for in a woman thoſe hayres are an eſpeciall deformity. Hence alſo (ſaith *Galen* in the 14 chap. of his 11 book *de vſu partium*) a man becommeth more venerable, eſpecially if whē he be grown to a ripe age the haires alſo do plentifully compaſſe his mouth on euery ſide, for which cauſe alſo nature hath left the Cheekes and the Noſe bare and without haire.

The skinne,

The hayres.

This skin of the face is diuerſly perforated for the eyes, the eares, the noſthrils and the mouth; partly that the ſenſible obiects might haue the freer acceſſe; partly to intromit ayre and nouriſhment and to auoide excrements. And theſe perforations if their actions bee alwayes required are alwayes open. As the noſtrhils for reſpiration; the eares for hearing becauſe theſe two were alwaies neceſſary. As for thoſe whoſe functions were not ſo indefinent, eſpecially in the time of ſleepe and for the auoyding iminent dangers, thoſe perforations I ſay, for more ſecurity may be ſhut as the eyes and the mouth.

The perforations of the face. Their vſe.

The fat of the face is very little and that that is, is about the Cheekes.

The fat.

The fleſhy membrane which in the reſt of the body is almoſt wholy neruous, in the forehead is fleſhy and muſculous; ſo cloſe ioyned to the skin that it can hardly be ſeparated there-from. And it is red becauſe of the muſcles of the face which grow vnto it. Betwixt this fleſhy membrane and the skin the veines before ſpoken of do runne where alſo are many glandules diſperſed, as vnder the rootes of the eares in which the diſeaſe is bred that we call *Parotis*, as alſo betwixt the lower Iaw & the inferior part of the Cheeks where thoſe Tumors ariſe which we cal *Scropuhlæ* or the Kings euill.

The fleſhy membrane.

The veſſels and the glandules.

The proper containing parts are muſcles, bones and griſtles which make the frame of the face it ſelfe. The muſcles are, of the forehead, of the eye-browes, of the eye-lids, of the noſthrils, ſometimes alſo of the eares, of the lips, of the lower Iaw, and of the Cheekes. The bones are, the forehead-bone, the fixe bones of the eyes, three of the Noſe, ſixe of the mouth, that is to ſay, two of the vpper Iaw, and two of the nether Iaw, and as many of the Palate. The Griſtles are, of the eares & the noſe which are diuerſly ioyned with the bones.

The proper containing parts.

The parts contained in the face are the ſeates of the foure ſences; whoſe organs either it containeth as it doth thoſe which haue no place within the skull, or elſe it prepareth a way for them that lye hid within the Scull.

The parts contained.

Theſe Organes of the ſenſes are the Eyes, the Eares, the Noſe and the Mouth, wherein are contained the Tongue and the Throttle which are the inſtruments of the taſte & the voyce. And indeede becauſe the Organs of the ſenſes are placed in the face, it is truely called the Image of the minde, for as *Laurentius* ſaith truely, in the eye-browes dwels

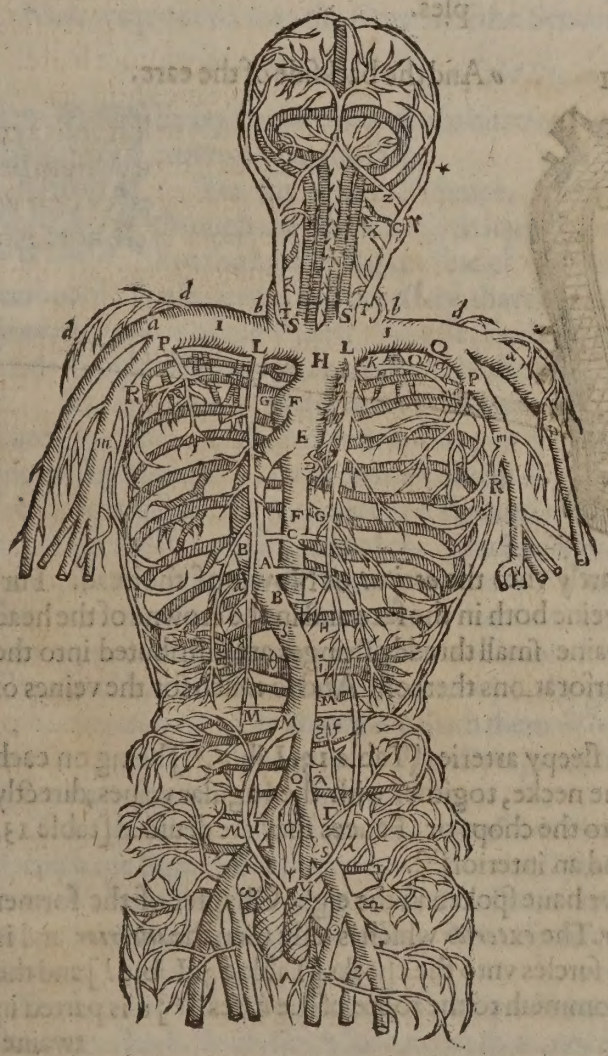
pride

pride, in the Cheekes ſhamefaſtneſſe, in the Chinne maieſty, in the Forehead wiſedome, finally, in the whole countenance beauty and honeſty. But to ſpeake more like a Phyſitian, in the Face doe appeare the manifeſt ſignes of life and death, and therefore *Hippocrates* in his Prognoſtiques commands the Phyſitian firſt of all to take viewe of the ſickmans face, whither his countenance bee like that it was in his health, or whether it be much changed in colour, figure and magnitude. How the mind ſhineth in the Face.

But before we come to the particulat handling of the Organes of the Senſes, it ſhall not be amiſſe to giue you in this place a light view of the Veſſels of the Face and of the Muſcles which mooue the skin of the Head. The Veſſels therefore which are deriued through the face are Veines and Arteries. The Veynes are called Iugulars, whereof one is internall, [Tab.6.lib.6. SS] of whoſe diſtribution we haue ſpoken in the eight chapter of the precedent Booke. Another externall [Tab.6.lib.6.TT] which ariſeth out of the vpper part of the *Subclauian* branch, and aſcendeth on the ſides of the neck vnder the chin yeelding ſurcles to all the outward parts of the Necke, the Head and the Face on his owne ſide. But for the moſt part vnder the roote of the eare, [Tab.6.lib.6. V] it is diuided into an vtter braunch [Y] and an inner. [X] The inner branch reacheth vnto the muſcles of the mouth, the chops, and the bone *Hyois* as before is ſaide. The vtter creeping along the skin and the Muſcles and skin of the head, beeing vnder the eare ſupported with Glandules, is parted into two branches, whereof one bending vnto the foreſide of the face [Tab.6.lib.6. Z] attaineth vnto the Noſe and the Cheekes, and in the middle of the forehead is ioyned with a braunch of the other ſide, and maketh the fore-heade Veine which in ſome caſes wee vſe to open. [Tab.6.lib.6. *a*] The other braunch paſſeth by the ſide and ſprinkleth his branches partlie Prediction by the Face. The veſſelles of the ſame. The Veines.

Table 6. ſheweth the trunke and branches of the hollow veine as they are diſſeminated through all the three Regions of the body.

TABVLA VI. Lib. VI.



Q. The double Scapularie, or the veynes of the ſhoulder-blade.

RR. The Lower Cheſt-veine.

SS. The internall Iugular Veine.

TT. The externall Iugular Veynes.

V. The externall Iugular Veine diuided into two vnder the roote of the eare.

X. The inner branch thereof.

Y. The outer branch thereof.

Z. A branch proceeding from the vtter Veyne nexte aboue named, to the Face.

a. The forehead Veine.

c. A branch creeping vppe the Temples.

* A ſurcle reaching to the Nowle or backeſide of the head.

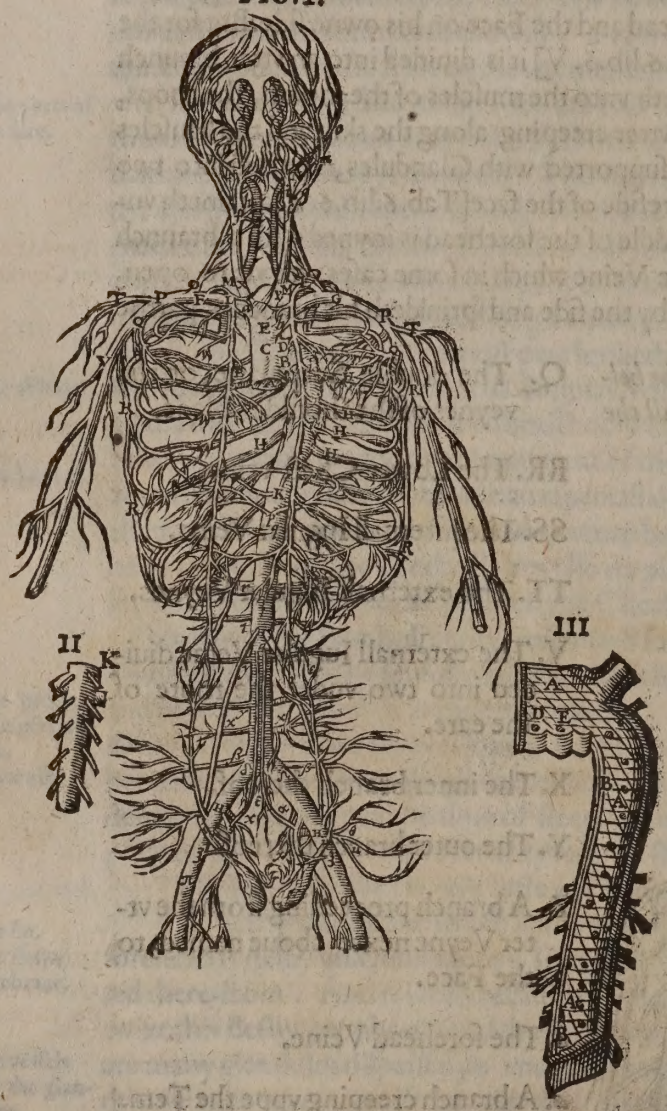
Table 13. Fig. 1. ſheweth the trunke of the great Artery, together with his branches as they are diſſeminated through the three bellies or Regions of the body.

The ſecond Figure ſheweth a portion of the Arterie as it is on the backſide, from whence it ſendeth branches to the diſtances betwixt the lower ribbes.

The third Figure ſheweth a portion of the great artery, where it yſſueth out of the heart it is here ſhewed open: & by that meanes we may better perceiue his Coates and Fibres.

TABVLA. XIII.

FIG. I.



TT. The Artery called *Humeraria.*

V V. the remainder of the Axillarie Artery reaching to the armes.

X Y. the right and left *Carotis* or the ſleepy Arteries.

e e. The coniunction of the Mãmary with the Epigaſtricke Arteries.

ff. The diuiſion of the ſleepy Arteries at the *chops.*

g. The externall branch.

h. The internall branch which is deriued to the throttle, the chops and the tongue.

i. This at the Baſis of the Skull is diſtributed into two branches.

l. the diſtribution of the braanch *g* vnto the Cheeks and the Muſcles of the face.

m. The diſtribution of the braunch *g* vnder the roote of the eare.

n. The ſame branch creeping vp the Temples.

o And the backſide of the eare.

vnto the Temples [Table 6. Lib. 6. *a*] partly vnto the *occiput* or Nowle of the head. Furthermore the branches of this *exterior* veine both in the face and in the crowne of the head are diuerſly mingled, from which certaine ſmall threddy ſtringes are diſtributed into the ſeames of the Skull and the manifold perforations thereof. And ſo much for the veines of the face.

The arteries of the face

The arteries called *Carotides* or the ſleepy arteries [Table 13. Lib. 6. [xy]] being on each ſide one, aſcendeth vp on the ſides of the necke, togither with the Iugular veines, directly vnto the head, and when they come vnto the chops or Fauces they are deuided [table 13. lib. 6. [ff]] into an exterior branch [g] and an interior [h].

Of the diſtribution of the *interior* we haue ſpoken in the eight Chapter of the former Booke. Now concerning the *exterior*. The *exterior* which is leſſe then the *interior* and is ſeated without the Fauces reacheth his ſurcles vnto the cheeks [Table 13. Lib. 6. [l]] and the muſcles of the face; afterward when it commeth to the roote of the eares [m] it is parted in twaine.

twaine. One of them creepeth to the backside of the eare at[°] from which two arteries do vnder the eare passe into the lower iaw, and according to the length thereof are dispersed vnto the rootes of all the lower teeth: but another part yssueth at the hole which is in the chinne, and so creepeth along the neather lip. The other artery of the by-partition at[P] creepeth vp the temples and the forehead and is consumed in the muscles of the Face. And so much of the vessels.

The Skin of the head is in many men mouable, but of the forehead in all men; not onely by the benefite of the fleshy membrane, which degenerateth into a musculous substance hauing right fibres, but also by the help of two muscles; assured so to be, both by the course of their fibres as also by their motions which appeare in these after the manner of other muscles and not like the motion of the fleshy membrane. These are scituated in the forehead [Table 6. figure 1. ^] and doe arise aboue where the hayre determines; sometimes as high as the crowny seame neare the Temporall muscles; the right at the right and the left at the left Temple, (where the fleshy membrane cleaueth so close to the *Pericranium* or skul-skinne and the Skull it selfe, that it is altogether immouable: So that the forehead and the Eye-browes are mooued when the membrane is at rest) and toward the common seame which distinguisheth the bones of the head from those of the vpper iaw are implanted with right fibres aboue the eyes and the nose into the skinne at the browes as at the parts which are to be moued. The muscles of the forehead.

I sayed these fibres were right and not oblique as some haue thought: and here Chyrurgions must obserue that in opening Apostemations in that place they make not their incitions ouerthwart as the wrinckles of the skinne doe goe, but according to the right fibres. A good note for Chyrurgions.

These two muscles are a little disioyned in the middest, and that is the reason why the top of the forehead is not moued. Vpon this coniunction some haue thought them to be but one muscle. Against whome wee shall further dispute in the proper place where wee treate of these in our book of muscles. There are also other muscles which draw the skinne of the head backward, but those belong not to this place. Why the top of the forehead is not moued.

Now we proceed vnto the Organs of the Sences.

CHAP. II. *Of the Eye and parts thereof.*

WEe sayd before that the habitations or residences of foure of the Sences were contayned in the face.

The fift externall Sence, which is the Sence of Touching is dispersed through the whole body & hath no proper seat in the face, all the rest haue. For the head being the seat of the Animall faculties and the habitacle of the reasonable Soule; it was also necessary that the Sences, which as *Hippocrates*, in his Booke *de morbo sacro* or of the Falling sickenesse, sayth, are the messengers and interpreters of the Soule, should also haue their residence in the head. Why 5. sences

These outward Sences are fiue as there are fiue simple bodies, the Heauen and the foure Elements. VVherefore according to the *Platonists*, the Sight answereth in proportion to the *Element of Starres* whose obiect is shining. The obiect of the Smel is fiery, and therefore it is sayd that *fragrantia* are *flagrantia*. The obiect of the Hearing is ayrie: the obiect of the Taste is watery, and of the Touch earthy. But amongest these the Sight is the principall, which with hearing makes a mannes life much more happy, albeit without the Taste no man can be so well nourished. For those who either by Nature or by Accident are blinde do account themselues therein miserable; for as the Sunne (saith *Galen* in the tenth Chapter of his third Booke *de vsu partium*) in the great world, so is the Eye in the body of a creature; and therefore *Hesichius* calleth them ἡέλιου πύλαι *Solis portæ*, The dores of the Sun; and therefore we will first intreat of the Eyes, as also becausse amongest all the nerues the Opticke nerues haue the first place. How the sences answere the elements. *Galen.* *Hesychius.*

The Grecians call the Eye ὀφθαλμὸς *quasi* ὠπὸς θάλαμος, becausse it is the couch or bed out of which the Sight shineth. And therefore the Eyes are called by others φάεα, becausse from them φῶς that is the light proceedeth. The Latins as *Varro* and *Lactantius* call them *oculi*, *ab oculendo vel occultando* from hiding, becausse they are couered and hidden within their Liddes. The names of the Eyes.

These Eyes are the Organs of the faculty of Seeing, which we vse (sayth *Galen* in the fift Chapter of his 8. Book *de vsu partium*) as spies, not only to auoyd those things which wold of-

offend vs, and to leade vs vnto that which is profitable, which we is common to vs with bruite beasts, but especially that by those things which are visible we may take consideration of the omnipotency of the inuisible God. Hence it is that *Plato* said wel, that if we wanted our Eyes wee should bee ignorant of that excellent order which Nature hath established in the frame of the world and of our own bodies. *Aristotle* addeth that the Science or exquisite knowledge of all things is exceeding much furthered by the eyes. And therfore *Galen* calleth them diuine members: Seeing therefore their necessity is so great it is no wonder that God the Creator made them after so excellent a manner as it were a curious modell to manifest his Maiesty and wisedome.

Their excellency.

They are scituated in the head as in the higheſt and best defensed place of the body, immediately vnder the forehead as Scoutwatches: for as watchmen are placed in high standings and turrets that they may further of discerne whether any enemies be approching or lye in ambush, so the eyes are set aloft to foresee and giue warning of any danger that may be toward vs. *Galen* and *Auicen* haue conceiued that the head was especially made for the vse of the eyes, their reason is, because the optick nerues being very soft, could not safely be placed farre from them. They are seated in the forepart of the head, whereof *Galen* in the first chapter of his tenth booke *de vsu partium* rendreth a reason, because saith hee the Instruments of this sense do require soft nerues which could not bee produced from the *Cerebellum* or After-braine as being much harder then the braine it selfe.

Their scituation.

The reason thereof.

Moreouer being placed before, they are directly opposed to their obiects, and we moue forward, neyther can we discerne eyther on the side, or behind vs, vnlesse wee turne our heads about. They are seated within bony cauities which *Pollux* calleth κογχὸι or Orbes, & that for security; haply also because the spirits might be lesse dissipated.

They are in number two, (as also are the other instruments of the senses) mooued together and at once with the same motion, that the sight might be more perfect; for if one of them had beene lifted vppe and the other depressed, then euery obiect howsoeuer would haue appeared double: for it was necessary that the *axes* or *diameters* that is, the imaginary lines of the pointed obiects should determine in one and the same place: and this ioynt action of the eyes is assisted by the coniūction of the motiue sinewes in their originall as we haue already declared. Obserue further with *Aristotle* in the 17 Probleme of the 10 Section. That amongst all Creatures a mans eies stand neereſt together for his proportion. Their figure in a man is round and spherical [table 2, fig. 3, and 4] but in other creatures they are not perfectly round, but eyther oblique or depressed, [tab. 2 fig. 5.] and no maruell seeing the whole figure and fashion of a mans body differs so much from other creatures. But if you consider them together with their muscles which grow to their back-sides, then is their figure turbinated like a sugar-loafe. [tab. 1, fig. 4, and 9] The reason why they were made round, was partly that they might be more capatious because they were to containe many parts of great vse. Againe, that figure is the strongest and lesse subiect to offence by outward iniuries. Finally, their roundnes makes their motion more nimble, to which end also they are smooth & slippery that we might command our sight euery way at our pleasure and vpon the suddaine. Wherefore the Maisters of the Opticks say that because of the orbicular or round figure of the eye, the beames from which side soeuer they come are broken at the Perpendicular, that is to say, they arriue directly in the center of the eye. Their magnitude is proportionable to the magnitude of the body and their owne vse. And heere we are to consider two kindes of parts; the one of those which are disposed about the eyes for their defence: the other, whereof the eye is compounded. For defence Nature hath compassed them with bones which frame their Orbe, and beside these they are walled, aboue with eye browes, before which lids and in eyther place fenced with hayres and the skin. For first of all the brim of the eye-lids stand as a wall of defence with their hayres shot out that no final motes or other annoyances might fall into the eyes when they are open. Then the lids themselues, that closing together they might shut vp the eye if any greater body or more violent offence should be offered thereunto. Furthermore, to defend them from violence, aboue they are secured by the eye-browes, below by the Cheekes, at the great angle with the Nose, at the lesser by the production of the yoke bone; and so if any greater body do rush against the eye, it is receiued by one of these, the eye which is in the middest remaineth vnoffended The motion also of the skin as wel that of the forehead as also that of the cheeks is a great security vnto the eie, for the skin being contract the eye is as it were drawn inward, & the same again extēded openeth thē wide. The orbe of the eye is round, [ta. 2, li. 7 fi. 6, at ᵠ ta. 12, fi. 8, betwixt ˣ and ᴿ] that

Their figure.

The reason thereof.

Their magnitude.

How they are defended.

Their parts.

that therein the eye might b e better rowled: long, becauſe of the muſcles whereby the eye ismooued, and compaſſed with a *Perioſtium* or thin membrane. It is formed of the bones of the head and of the vpper iaw. But *Aquapendens* addeth alſo the ſpongy bone which we call *Ethmoides*. The bones of the head which make the orbe of the Eye, are the foreheade bone and the wedge-bone, whence it is that in theſe dennes of the Eyes there be many ſutures and holes to be found. The forehead bone whoſe outward ſeat or table is ſmooth, maketh the vpper Arch of this roofe: and where the tables are ioyned againe, there in the place of the Eye-browes it buncheth outward [Table 3. lib. 7. figure 8.[ARX]] and ſo defendeth the Eye. The wedge-bone is in the backe part of the hollowneſſe or cauity of the orbe, where it is perforated with foure holes. [table 3. lib. 7. figure 8. neare [DG]] The bones of the vpper iaw which help to make the orbe of the Eye are 3 the firſt which maketh his outward eminence below. [table 3. lib. 7. figure 8. Γ] The ſecond and the third [table 3. lib. 7. figure 8. ΔΘ] are in the inſide, very thin bones, becauſe the protuberation or ſwelling of the noſe is alſo a defence in that place. The fourth bone of the vpper iaw lendeth a part to the framing of this orbe where the cheekes riſe vp into a ſwelling prominence [table 3. lib. 7. fig. 8. neare [i].] The bones of it.

The ſutures or ſeames in the bones of the iaw are three; one at each angle or corner, the third in the lower ſide of the orbe: the ſutures of the ſpongie bone are two, both at the great angle. Finally, there are other ſutures betwixt the wedge-bone and the forehead-bone. And vpon theſe ſutures are the *Pericranium*, the lower oblique muſcle and the pully ſuſpended. The Sutures of it.

The holes in the orbe are three and thoſe very large; one in the hindmoſt part which is round, made for the tranſmiſsion of the opticke nerue: the ſecond is in the lower part of the cauity of the orbe, and is a long rift through which the nerue which mooueth the eye together with ſome veines and arteries are deriued vnto the Eyes and their muſcles. The third is at the inward angle & perforated into the bones of the noſe, through which holes ſometimes a part of the teares do yſſue. The holes 3.

In theſe orbs of the Eye doe ariſe on either ſide two *ſinus* or circles, which *Ariſtotle* in his firſt Booke *de Hiſtoria Animalium*, calleth common parts of the vpper and neather Eye-lid, becauſe they are made of both the Liddes extended out in length. Theſe circles the Grecians call κανθοὶ ἀπὸ τῦ κνήθεσθαι, that is, from a Sence of Itching, becauſe in them oftentimes by reaſon of the teares or of ſome other humour we finde a notable itching. The angles or corners,

The Latines call them *anguli oculorum*, we the corners of the Eyes, wherein the teares & whatſoeuer yſſueth from the Eyes is gathered together. The outward angle or corner toward the Temples is called *Canthus minor* or *externus*. The other inward to the noſe *Canthus maior & internus*. [Table 1. figure 1. and 6.[e] ſheweth the greater corner and [d] the leſſe] *Pollux* calleth the greater angle ῥαντῆρ the waterer, and *Heſychius* πηγὴ or the fountain, becauſe from thence the teares doe yſſue. Their names.

But theſe names I take to be fitter for the orbe it ſelfe then for the corner of the Eye, for in each angle in the very extremities or ends of the ridge of the eye-lid both aboue and below there are two holes [Table 1. fig. 4. 7. 8.[mn]] which in the leſſer corner can hardly be perceiued when a man is aliue, but after death they are not at all conſpicuous; but in the inward and greater angle theſe holes are larger and eaſie to be perceiued if we marke them well eſpecially in women; whencehaply it is that they haue teares at command. But in the eye of an Oxe euen after he is dead they may eaſily be demonſtrated [tab. 1. fig. 4.[mn] fig. 7. and 8. they are only expreſſed in the greater corner at [n].] The holes of the eies.

Theſe holes are called by *Fallopius* in his obſeruations *Puncta Lachrymalia*, as alſo by *Platerus*, becauſe thorough them the teares doe diſtill, eſpecially by the greater, which Nature vſeth rather and oftner then the leſſe, becauſe the ſcite thereof is more declining. Although there is a more open way for them through the noſe, the bones of the vpper Iaw being notably perforated in the top of the noſe, which holes haue certaine paſſages, which vnder the caruncle are vnited into a common boſome ending in the cauity of the noſe, and this cauity is properly called πηγὴ that is, the fountaine. *Puncta lachrymalia.*

But this Bone becauſe it is of it ſelfe thinne and hollowed, beſide by the paſſage or canale before ſpoken of is ſometime exulcerated by the Acrimony either of other humours or of the teares; which ſayeth the Philoſopher in the 35. Probleme of the firſt Section, are ſoft and like vnto ſweate: and this kinde of Vlcer is called *Fiſtula Lachrymalis*, wherein if you preſſe the inner corner of the eie, you ſhal find a *Sanious* or mattery ſubſtance to iſſue. The diſeaſe called *Fiſtula Lachrymalis.*

This

This matter is also oftentimes thinner, of which *Hippocrates* speaketh in his Booke *De Prisca Medicina* where he saith, that oftentimes there is a Flux of humors euen to the eie whose acrimony exulcerateth the eye-lids, and the partes vnder them it gnaweth assunder, yea sometimes it eateth thorough the coate that compasseth the Aple of the eye. That therefore this exulceration might be preuented, Nature hath set at the inner angle a Caruncle or glandulous flesh which the Grecians call ἐγκάνθιδα or ἐπικάνθιδα, although *Ægineta* giueth it that name onely when it is growne aboue the due proportion. *Galen* in the eleuenth chapter of his tenth booke *de vsu partium*, calleth it σῶμα σαρκῶδες, *Corpus Carneum, The Fleshy body.* [Tab.1. fig.7. 8r] This Caruncle was made to defend the bone from the sharpenesse of the humors. Moreouer, it serueth for a couering whereby the perforations which we saide before were made through the bone, are as it were stopped with a sponge, through which the excrements of the eye may soke into the nose, but cānot returne againe to offend the face, or to make vs alwaies weepe. Wherefore, those whom we call Oculists, that is, such as professe and intend the cure of the eies; must take heed that they do not vse such sharp Medicines as may coliquate or dissolue this Caruncle. For we haue often seen that Medicines applied to the eyes haue through these holes past into the nose, and so haue beene cast out either by emunction or by the mouth. But because we are come to make mention of the teares, it shall not be amisse a litle to stand vpon the nature and manner of the auoyding of them.

The wisedom of Nature.

A Caution for Oculists.

Plato, Aristotle, and *Theophrastus* do thinke the teares are a kinde of sweate, or at least much like thereto. *Aquapendens* his conceite how agreeable it is to reason let others iudge, sure it is very quaint and witty, his words are these. The Tears are an excrement of the third concoction in the eye, proceeding from the nourishment of the Glassye and Cristaline humors; which excrement is engendred of blood as of his proper matter, yet is that blood diuersly altred by the temper of the eye. For from these humors of the eies there is a double excrement separated; one thicke, another thin. The thicke excrement is that blacke slime which cleaueth to the Coats called *Vuea* and *Choroides*. Another thin which are the tears to which a whayie or serous humidity may be added. Thus far *Aquapendens*.

Diuers opinions cõcerning teares.

Aquapendens. opinion.

But *Bauhine* is of opinion that these teares are the excrements of the Braine, whome happly it will be more safe to follow. Now whereas in euery concoction there is a double excrement separated, one thin another thicke. In this concoction which is celebrated in the Braine, the thicker excrement which is viscid and crasse Flegme is spit out of the mouth from the pallate or else descendeth by the nose. The thinner excrement is partly euaporated insensibly, partly it commeth away verie manifestly, and sometimes mixed also with a more crasse excrement: now it moysteneth the tongue & the mouth to make the speech freeer, and to helpe mastication or chawing of the meate. Sometimes it is transported to the whole face, but especially to the cheekes, to the temples and the eares; which may bee prooued by wounds inflicted vpon those places, which though they seeme to be healed, do yet notwithstanding for two or three moneths together euery day yeeld a great quantity of pure and wateriſh humour, issuing by the hole that is left in the woũd, which no art is able to consolidate or make vp, which obseruation we confesse we haue from that notable Anatomist & Chirurgion *Aquapendens*.

Bauhines opinion.

That moisture which is transmitted to the muskles is the matter of the teares, to wit, that whay which together with the blood is transported vnto the braine to bee ὑγρότης τροφῆς. *The vehicle of the nourishment*, that by the helpe thereof the blood might bee able to passe through the smal vessels which are dispersed through the substance of the brain, which whay beeing not fit for nourishment, in the nourishing of the braine is percolated through his thin substance, as the whay is separated from the milke. This moisture is gathered together in the bony orbe of the eye, which is indeede of so great capacity that the fourth part thereof is not filled by the muskles and nerues of the eye. It remaineth therefore after the manner of other excrements a conuenient time in that cauitie, and is sucked or drunk vp partly by the fat, partly by the Glandules which are of a rare and spongy substance. The reason why Nature detained these excrements in the orb of the eie was to moisten the Muscles, which because of their continuall motion were not onely in danger to be ouer-heated, but also to be exiccated and dried vppe; vnlesse they had beene moistened and refrigerated by this matter of the teares which swimmeth in a manner about the fat and Muscles of the eye. And this vse hath the moisture if it bee

The matter of the teares.

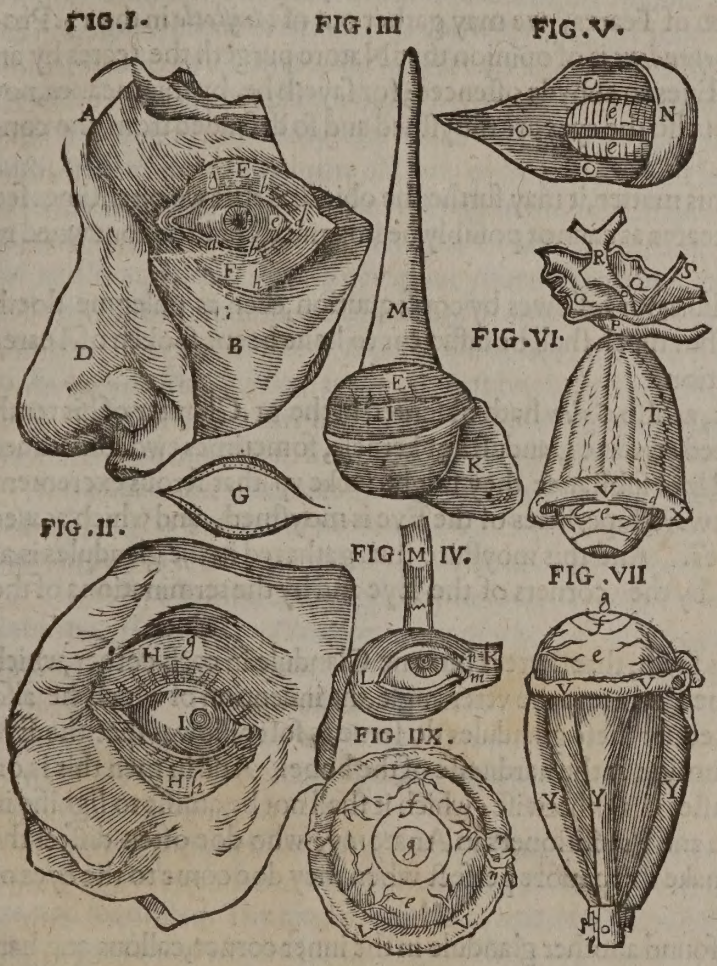
The great capacity of the orb of the eie

The inconuenience of the moisture detained.

moderate

Table 1. *Fig.* 1. *Sheweth the whole eye, not at all diſſected, his bones, together with the eye-lids and the hayres thereof.*
Fig. 2. *ſheweth the eye-lid hauing the skin taken away.*
Fig. 3, & 4. *Exhibiteth the muſcles of the eye-lids.*
Fig. 5. *Sheweth the eye-lids ſeparated and inuerted.*
Fig. 6, 7. *Sheweth the figure of the whole eye with his muſcles drawne out of the Scull and freed from the eye-lids.*
Fig. 8. *The foreſide of the globe of the eye.*

TABVLA. I.



A 1, The forehead bone.
B 2, The bone of the vpper law.
C 1, The yoke bone.
D 1, The Noſe.
E 1,3, the vpper eye-lid.
F 1,3, the lower eye-lid.
a a 1, the Tarſus or little griſtle wherein the haires grow.
b b 1, the haires of the eye-lid.
c 1,6, the greater Canthus or corner of the eye.
d 1,6, the leſſer Canthus or corner of the eye.
e 1,5,6,7,8. the membrane called Adnata which in the 6,7, and 8, fig. is intertexed or wouen with veines.
f 7,8, The Rainebow called Iris.
g 1,2, The hollownes of the vpper eye-lid and in the 7 and 8 the apple of the eye.
h 1,2, the vnder cauity in the lower eye-lid.
m n 4.7,8, Two holes in the greater angle or corner of the eye.
o 7. the opticke nerue.
p q 7, the *Pia meninx* at *p* and the thicke at *q* which do inueſt the optick nerue.
r 7,8, A Caruncle or little fleſh in the interior corner.
G, The Cartilages or griſtles of the eie-lids called *Tarſi*.
H H 2, The orbicular or round muſcle of the eye-lid without the skin.
I 2, the hornie coate containing the Rainebow and the apple of the eye.
K 3,4, the orbicular muſcle of the eye-lid ſet alone, but in the 4. it is deſcribed cõpaſsing the whole eye-lidde which *Veſalius* diuided into two.
L 4, In this place *Veſalius* ſet the ſecond.
M 3,4, the right muſcle of the eye-lid ſet alone
N 5, The outward part of the eye-lid.
O O O 5, the concauous and interior face of the eye-lid.
P 6, the interior portion of the wedge-bone where-through the opticke nerue doth paſſe. Q Q, 6, A part of the thicke membrane or *Meninx*. R 6, the concurſe or meeting of the opticke nerues. S 6, The mouing nerue of the eye. T 6, the fat betweene the muſcles, V 6,7,8, A part of the coate called Adnata ſtretched vnder the eye-lids. X 6, Membranes going from the Scull-skin to the Tarſus or griſtle of the eye-lids, Y 7, the muſcles of the eye on the one ſide.

moderate, for if it be immoderate and detained in the eye, it hindereth the motion of the muſcles: wherefore Nature being heerein very prouident and wiſe hath framed and prepared two wayes for the expurgation thereof. One by the corners of the eyes, another by perforations into the bones of the Noſe as we ſaide euen now. For if the teares ſhould perpetually drop out at the eyes they would haue deformed the face, as wee perceiue by thoſe who are troubled with the diſeaſe before named caled *Fiſtula lachrymalis* or the dropping Fiſtule,

Nature therefore ſtuddying to preſerue the beauty and comelineſſe of the face as alſo the cleereneſſe of the ſight hath prouided meanes to moue them by expreſsion or by dilatation and attraction. By expreſsion the teares are mooued eyther when we rub our eyes, or by the coldneſſe of the ayre, or by the winde, or by ſome griefe of minde and weeping fit; at which times they drop out like plentifull ſweate, or rather like a bubling ſtreame through thoſe holes which we ſaide before were formed in the terminations of the brims of the eye-lids: for at ſuch times the muſcles of the face and of the adiacent parts doe con-

The mouing of teares, how many wayes. by expreſſion

tract

tract themselues sometimes with wayling and mourning sometimes without; sometimes the Respiration being cut off in the middest with a sobbing stay and the voyce broken about the top of the *Larynx*, yea sometimes quite intercepted: and thus is this matter of the teares moued by Expresion.

2 by dilatation. By dilatation it is drawne out sometimes by heat, often by laughter, sometimes by the Sunne, for sayeth *Hippocrates* in his Booke *de videndi acie*, the Eye being not able to resist a bright obiect, calleth out the matter of the teares to succour it, which also in the conflict is heated. Anger also and a sharpe Ague doe by dilatation prouoke and cal out the matter of the teares.

Hippocrates.

And in such an Ague sayth *Hippocrates* in his first Book *Epidemion*, if other signes be not mortall, teares so appearing doe foreshew a Fluxe of bloud by the nose. That these are the very causes of the profusion of Teares, we may gather out of *Aristotle* in the 13. Probleme of the fift Section. *Aquapendens* is of opinion that Nature purgeth the teares by an expulsiue faculty giuen to the Eyes to auoyde offences; for sayeth he, by this meanes, not onely Nature is vnburdned but also the eyes are moystned and so defended from the contaction of cold and heate.

Aristotle.

Obiection. But not to contend about this matter, it may further be obiected that we oftentimes see at once so great a quantity of teares as cannot possibly be imagined could be contayned in the orbe of the eye.

Solution. I answere, that this serous humour followes by consequution, euen as phlegme doeth fall out of the braine. And thus much shall be sufficient to haue beene spoken of Teares and the manner of their euacution.

The glãdules of the eye. At either angle of the Eies, as also *Galen* hath obserued in the 11. Chapter of his tenth Booke *de vsu partium*, are placed certaine glandules or kernels, sometimes two sometimes more: that with their rare and laxe substance they might sucke vp that serous excrement of the braine, by which the outward superficies of the Eye is moystned, and which as wee sayed is the matter of the teares. And this moysture thus gathered in the glandules is at conuenient times euacuated by the corners of the Eye and by the terminations of the brimmes of the lids.

Fallopius. *Fallopius* in his obseruations sayth, that there is but one Glandule in each corner, which is found in the vpper part of the Eye neare the vtter angle, the inuention of which he also attributeth to himselfe.

Their vse, Moreouer these glandules do serue as soft pillowes that the Eye might not be offended in his motion at the hardnesse of the bone. And in men this is on this manner: But in bruite beastes it is otherwise; which it shall not be amisse to signifie in the fauour of young beginners and Practitioners in Anatomy, who doe often dissect the eyes of Oxen and Sheepe to make them more perfect when they doe come to the eyes of Men.

the same in an Oxe. In an Oxe Eye therefore is found another glandule in the inner corner, callous and harder then that in a man, which should seeme to be there scituated because of the membrãe with which they wincke, which membrane is most like to that we call the Naile of the eye, very thinne and like the horny coate, or something of the Nature of a gristle. This Nayle or membrane of which *Aristotle* speaketh in the 12. Chapter of his second Booke *de Historia Animalium*, is moued with voluntary motion to the outward angle and couereth the eie

A membrane in the eye of an Oxe, euen when the lids are open. For about the roote of this callous glandule there cleaueth a strong membrane, whose vse haply is, that while the Skin is drawne to the opposite angle that glandulous body should be streatched or bent like the horne of a bow, and when the skinne is remitted, returne backe and draw it into his proper angle. And truely this membrane is drawne to the oppositе angle by a double cord, the one is aboue, the other below lurking vnder the coate of the eye which we call *Adnata*, and arising from a certaine muscle scituated in the vtter angle, which muscle *Fallopius* accounteth to bee a part of that muscle which draweth the whole eye outward. And thus much concerning the parts of the orbe of the Eye.

CHAP. III. *Of the Eye-browes and Eye-lids.*

the eie brows THe Eye-browes with *Aristotle* in the ninth Chapter of his first Booke *de Historia Animalium* we referre vnto the Eyes. They are called in Latine *Supercilia*, because they be *super cilium*, that is, aboue the haires of the Eye-lids. *Hippocrates* in his Booke *de locis in homine*, as also the rest of the Grecians after him call them ὀφρύες. They are, sayth *Rufus*, hayrie extremities of the forehead, or

haires

haires that grow aboue the eies which are diſtinguiſhed vnder the forehead on either ſide. Theſe eie-browes are compounded of skinne, fleſhy fibres produced from the muſcles of the forehead, fat and haires. The skin is thick and hard, thick the better to defend the eyes, hard, that the haires might neither be too many, nor grow into too great a length, for euen as ſaith *Galen* in a marriſh and weeping ground no graſſe is brought forth neither yet in a ſquallid and hot ſoile, ſo when the skinne is either too dry or too moyſte the haire cannot grow. Whereof they are compounded. A fit compariſon out of *Galen*.

Theſe haires are called by the Phyſitians as *Pollux* witneſſeth τυλοὶ, & are bred with vs whē we firſt come into the world, as alſo are the haires of the eie-lids, whence it was that the Egyptian Prieſts who vſed to ſhaue all their haire did notwithſtanding ſuffer theſe to grow. And although theſe haires are of an equall length, number and thicknes, yet are they not right but grow crooked and oblique, bowing after the roundnes of the eie, that they might the better auert and turne aſide whatſoeuer ſhall fall toward it. If they had bin too ſhort, too few, or too thinne, they would not ſo well haue defended the eies. Againe, if they had been too long or too briſtly they would haue bin an impediment to the ſight. In ſome men ſaith *Ariſtotle* when they grow old they encreaſe vnto ſuch length that they ſtand in neede to be cut, the reaſon whereof he rendreth in the 15. Chapter of his 2. Booke *de part. animalium*; becauſe they are placed in the coniuncton of the bones which in old age are looſed, and ſo a greater quantity of vapour yſſueth from their diſiunction. But howe the diſpoſition of the minde may be obſerued from theſe hayres according to *Ariſtotle* in the 9. Chapter of his firſt booke *de Hiſtoria animalium*, and how the antients (as *Cicero* reporteth in his oration for *Roſcius*, and in the firſt booke of his Offices) placed a part of the Soule in the eie-browes *Bauhine* hath well declared in his booke *de partibus externis*, to whome we refer him that deſireth further ſatisfaction. Why they grow long in old men.

The middle place betwixt the eye-browes which for the moſt part is without hayres is called by *Ruffus* and *Pollux* μεσόφρυον, in which place *Straton* the Philoſopher as *Plutarch* reporteth placed the ſeat or principall reſidence of the Soule.

Theſe Eye-browes although they be drawne vp by the muſcles of the forehead; yet in ſome men (ſayth *Iulius Placentinus* out of whome we haue taken their figure) there are two muſcles found in the *occipitium* or nowle of the head [Table 4. fig. 1. C the other in the ſecond figure at aa is retracted aboue the noſe like the pannicle inuerted] which leading the skinne of the head backward doe alſo draw the eye-browes with it, as we ſhall ſhew in the fourth Table figu. 2. c; where alſo wee will exhibit the orbicular muſcle which draweth the eye-browes downward. How they are moued.

Concerning the vſe of the Eie browes, the Philoſopher in the 15. Chapter of his ſecond Booke *de partibus Animal.* ſayeth; that as well theſe as the haires of the eye-lids were created for deféce. The eie-browes are as a penthouſe to caſt of the humors that fall from aboue: yea ſaith *Galen* in the 14. chap. of his 11. booke *de vſu part* : they are like a wall of defence which receiueth the firſt brunt of the irruption of any thing that would offend the eies: which vſe alſo *Cicero* maketh mention of in his 2. booke *de Natura Deorum*.

It was not ſufficient that the eyes ſhould be walled about with bones, and as it were included or ſhut vp in bony dens, and defended by the eye-browes from thoſe things which ſhould fall from the forehead, becauſe their forepart was expoſed vnto many dangers. For being by nature made ſoft and tender for the more facile and eaſie reception of the ſpecies or formes of things outwardly directed vnto them, they muſt needes by diuers wayes be in danger of offence. Wherefore Nature very prouidently hath fenced them with ligaments and lids, wherewith as with leafe-dores not only the eies themſelues but their whole orbes are ſhut vp, and thence it is that thoſe creatures the outward skin or coate of whoſe eyes is notably hard, as *Galen* well obſerued in his booke *de inſtrumento olfactus*, haue no eye-lids at all, becauſe their eies were not ſo ſubiect to danger. Of the eie-lids. What creatures want eie lids.

Theſe leafe-gates of the eies are called by the Grecians βλέφαρα *quaſi* τῆ βλέπουλος φαρέα, that is, *The Coates of the Sight*. Thence alſo they are not vnfitly called by a Poet ὀμμαλόφυλλα, that is, *The leaues of the Eye*. *Cicero* calleth them *Palpebræ*, either becauſe in their ſudden and frequent motions, they doe *Palpitare* that is tremble, or elſe becauſe they are often ſubiect to a trembling weaknes. *Pliny* cals them *Genæ*; *Feſtus Cilia*. The names of the eie-lids,

The eie-lids are two in each eie, for it is cut through the middeſt and diuided into an vpper & a lower, for in both the corners they are manifeſtly cōtinuated, the vpper [ta. 1 fi. 1. & 3.a]

in a man is much more moouable then the lower, which by ſome is thought to bee immoouable of it ſelfe and onely mooued by the motion of the cheeks as *Archangelus* conceiueth. So *Galen* ſeemeth to ſay in the ninth chapter of his tenth booke *de vſu partium*, but more plainely in the tenth Chapter and in his fourth Booke *De Locis Affectis*, vvith whom alſo *Veſalius* conſenteth & *Laurentius* yeeldeth a reaſon, for, ſaith he, what neede was there that the lower eye-lid ſhould bee mooueable ſeeing by the motion of the vpper downward the eye is cloſed to his bottome, and by the motion thereof vpward the eie againe is ſufficiently opened? But *Platerus* thinketh that the lower eye-lid is mooued ſomething vpward when we ſhut our eyes. And with him *Bauhine* is of opinion that the lower lid is mooued by a Muſcle, although his motion be farre more weak and leſſe conſpicuous then that of the vpper. For if both the eye-lids were made for the vſe of the eies then was it neceſſarie that either the vpper ſhould mooue downward, or the lower vpward, or the one meete the other. Now wee finde by Diſſection that in the lower lidde there is a ſemicircular Muſcle as well as in the vpper, and in a creature aliue if we marke the eie well, we ſhall perceiue the lower lid to mooue though not ſo manifeſtlie as the vpper; but in Birds (as *Ariſtotle* obſerued in the 13. chapter of his 2. booke *De Partibus Animalium*) the lower eie-lid is onely mooued.

Whither the lower lid bee mooueable.

The lower lid is onlie moue able in Birds.

Neither could ſo ſodaine and quick motions come from the vpper lid alone, becauſe the motion downward would haue needed a longer time then was fit for ſo quicke diſpatch, and therefore they ſooner meete if they ioyne to aſsiſt one another. But the vpper lid in a man and in thoſe creatures in whome the lower is not ſo ſwiftly mooued is larger, becauſe it was to bee let downe much further then the lower was to be raiſed vp. On the contrary in birds the lower lid is larger then the vpper.

The lower eie lid why leſſe.

The lower lid [Tab. 1. fig. 1,3. [F]] is much leſſe then the vpper, and if it had not beene ſo little falling vpon it ſelfe it would haue beene corrugated, wrinckled or relaxed and haue falne from the eye. And which is more, the eye would haue become bleared, wateriſh and ill affected. Beſide many things might haue gathered therein which woulde haue hardly bene gotten out. Wherefore it was much fitter that this lower lid ſhould be but little and ſit cloſe to the eye, that ſo whatſoeuer getteth within it might bee better preſſed out. We therefore reſolue according to our ſenſe, that both lids are moued, the vpper downward and the lower vpwarde that they might meete one with another. But becauſe the lower is by much the leſſe, therfore is his motion weaker and more obſcure, as the motion of the vpper is more euident becauſe it is the larger.

Whereof the eie liddes are compounded.

Theſe eye-lids are compounded of skinne, the fleſhie Membrane, a coat, Muſcles, their brim, and the haire. Wherefore their ſubſtance is partly ſoft, partly harde. Soft as it is Membranous and Muſculous, hard as it is griſtly: for if (ſaith *Galen* in the ſixte chapter of his tenth booke *de vſu partium*) it had beene onelie fleſhie and ſoft, becauſe they are firſt expoſed to danger, they would haue beene ſooner offended then the hornie coate of the eie, yea they would eaſily haue falne, become rugous and would not ſo equallie haue beene ſtretched ouer all the parts of the eie.

On the contrary, if they had beene hard and bonie, they would not ſo eaſilye haue beene mooued, neither could the hornie Membrane or coate haue touched them without danger of offence.

The reaſon of their compoſition

It was therefore fit that the eie-lid ſhould bee made of ſuch a ſubſtance as ſhould both eaſilie bee mooued and yet not offend the eie by contaction.

The thinnes of their skin & membranes

The skinne of the eie-lid is the thinneſt almoſt of the whole bodie altogether without fat, leaſt thereby their motion ſhould be hindred. Their fleſhie Membrane is ſo thinne that together with their Muſcles it is ſcarſe ſo thicke as the Membrane alone which is vnder the skinne in other parts, ſo that the orbicular Muſcles ſeeme to bee nothing elſe then the fleſhie Membrane diſtinguiſhed with ſmall Fleſhie Fibres, as *Galen* ſaith of it in the ninth chapter of his tenth booke *De vſu partium*. And by reaſon of this tenuitie or thinneſſe of the Membrane and skinne of the eie-lids. *Ariſtotle* ſaith, that their skinne is without Fleſh, and therefore if it bee wounded will not ioyne together againe as it happeneth in the Prepuce or fore-skinne of the yard.

Ariſtotle.

The inner Membrane [Table 1. figure 5. [ee]] which is produced from the *Pericranium* is exceeding thinne and light. Thinner and lighter then the *Pericranium* it ſelfe, polliſhed alſo that it ſhould not hurt the ſight of the eye which moueth immediatly againſt it. This membrane

brane being produced into a length answerable to the length of the eye-liddes as also into their skin, doth make in the vpper & lower part a round angle, and becommeth duplicated or doubled, to which duplication is ānexed a certaine gristly substance harder then a membrane, which they cal τάρσος, we called it before the brim of the eie-lid, & this substance shut teth vp & comprehendeth the duplication before spoken off. The vpper part of this membrane compasseth and as it were subdiuideth the inner superficies of both the lids. The other couereth the *exterior* roundnesse of the eye aboue the tendons of the muscles as farre as to the *Iris*, and produceth that coate of the eye which is called *Adnata* (for to it it is continued) [table 1. fig. 7. v v] which louingly ioyneth the lid vnto the eye.

Now the thinnesse and the lightnesse of the membranes was necessary to further the swiftnesse and suddennesse of the motion of the eye-liddes; for if they had beene heauy they could neither haue been moued suddenly nor often, which two things were very necessary: the frequency of the motion to meet with whatsoeuer might affect the eye, the celerity to take away all impediments of the sight. It is no wonder therefore if Nature made the body of the eye-lids very thin, smooth and soft, that so they might be more nimble and prompt to moue at our pleasure. The reason of the thinnes is of the lids.

The motions of both the eye-lids are vpward and downward, there is also another motion made by them both together which is circular, wherein both the eye-lids are gathered together. For it was necessary that the eyes should bee opened and shut, for if they had beene alwayes couered with the lid, they could neuer haue receiued the images of their obiects, and if they had alwayes remayned open, neither had they been free from outward iniuries, and beside they would soone haue grown weake by reason of the perpetuall disipation of their inward light; wherefore it was of necessity they should bee opened and shut. And therefore *Aristotle* in the 13. Chapter of his 2. Booke *de partibus Animalium*, writeth that this motion is by an instinct of Nature not after the guidance of our will, and that the Eyes by that instinct doe winke at any thing that falleth toward them; but this conceit *Galen* reprehendeth in the ninth chapter of his tenth Booke *de vsu partium*, where hee sayeth, There are some Sophisters when they could not finde out either the muscles which moue the Eye-lids or the reason of their motion, they became so impudent as to deny that their motion depended vppon our will: but affirmed that it was Naturall like the motion of the arteries and of the heart, esteeming it better to teach a lye then to confesse their owne ignorance The motions of the eie-lids. The necessity thereof. *Galen.*

But this motion although it be voluntary yet it is partly free partly constrayned: the free motion is for the couering and custody of the eyes, if haply any thing should bee troublesome vnto them, as too strong a light, smoake, dust, a blow or whatsoeuer might happen vnto them from without. That motion we call Constrayned which is stirred vp by a corporiall affection or serueth thereunto, and this motion is exceeding suddain and swift, and therefore for the most part we do not marke it; whence it was that *Aristotle* rather thought it Naturall then voluntary; for example; when wee haue long time held our eyes open although there be nothing to offend them, yet we are constrained to close them vp or at lest to wincke, and that oftner and more suddainly in winter then in Summer, when the winde blowes then when the ayre is quiet. It may bee becauſe the eye is not able to endure the touch of the externall ayre, becauſe of the tendons of his muscles, which are of exquisite Sense and exposed almost naked to the aire, hauing nothing vpon them but the thin membrane called *adnata*; beside it hath beene often obserued that the Chrystaline humour it selfe hath bin condensed or thickned with cold to the great detriment of the sight. Wherfore that the eye might not be hindered at all from seeing, nor from preseruation of it selfe when neede doth require: the eye-lids were necessarily made with a sudden and swift motion to shut them and open them againe. The motion double or of 2 kinds. Voluntarie. Constrained. *Aristotle* excused. How cold offends the eye.

Now these motions are performed by two muscles commonly called the muscles of the Eie-lids: but *Archangelus* calleth them *musculi ocularii*. Neither do others agree in the number of these muscles, for *Galen* and the ancients as also *Vesalius* and *Siluius* doe make two, diuiding the orbicular muscle of which wee shall speake anon into two, whereof one, say they, lifteth the eie-lid vp the other depresseth it or moueth it downward. But the truth is, there is onely one muscle which shutteth the vpper lid according to *Columbus*, *Fallopius* and *Archangelus*. *Platerus*, *Bauhine* and *Aquapendens* affirme that that muscle contracteth both the lids. *Laurentius* indeede maketh this muscle double, and yet hee saith that both of them shutte the vpper lid. Hence it followeth that *Galen*, *Vesalius* and *Siluius* were ignoThe muscles of the eie-lids Diuers opinions concerning them.

rant of the muſcle that openeth the eye, which *Fallopius*, *Platerus*, *Bauhine*, *Laurentius* & *Aquapendens* will haue to be but one, but *Columbus* and *Archangelus* ſay there are two, the one of them we acknowledge, but that which they call the ſecond wee ſay mooueth the eye round.

The motions therefore of the eye-lids are performed by two muſcles, the one *right* [tab.1,M tab.2,β] of which *Galen*, *Veſalius* and *Siluius* were ignorant; and *Fallopius* aſcribeth the inuention thereof to himſelfe. This *right* muſcle which lifteth vp the vpper lid is ſcituated within the cauity of the bones; in the vpper part of the Orbe, aboue but neare the muſcle that lifteth vp the eye it ſelfe, to which alſo it is in figure very like and fleſhy, but leſſe and hath his originall from the ſame beginning with the other muſcles that moue the eye: to witt backward at the hole of the optick nerue. This muſcle is extended directly to the vpper eye-lid, and is inſerted with a broad tendon to the extremity of the lid, which we ſaid was griſtly and called *Tarſus*, and contracting his fibres inward draweth the lid vpward; the lower lid of his owne accord falleth downward into his owne place, and ſo the eye is opened.

The ſecond muſcle which is ſemicircular [tab.6,fig.1,c = tab.1,K] or orbicular is called by *Columbus*, *Falopius*, *Platerus* and *Archangelus* the firſt muſcle of the eye lid, but *Veſalius* and *Siluius* following *Galen* haue diuided it into an vpper and a lower part. The vpper part, ſay they, lifteth the lid vpward, the lower mooueth it downeward. *Fallopius* in his obſeruations confeſſeth that he was a long time of the ſame opinion with *Galen* and *Veſalius*; but in the yeare 1553, took knowledge of his own error being admoniſhed partly by *Oribaſius* in his booke *de diſſectione muſculorum* in what place he epitomiſeth the 29. chap. of *Galens* booke; partly by diſſecting the eye of a fiſh, called *Phoca*, which we call a Seale, which fiſh moueth both his eye-lids. *Laurentius* diuideth it into two, and calleth them the two muſcles which ſhut the lids, whereof one, ſaith he, ariſeth from the inward angle and compaſſeth the whole courſe of the hayres. The other ariſeth from the ſame angle and the roote of the Noſe, and is inſerted into the *Tarſus* or brimme of the lid. But in the deſcription hereof we will rather follow *Bauhine* who ſaith, That this orbicular muſcle is ſeated betwixt the fleſhye membrane and that which is produced from the *Pericranium* or Scull-skin. It is membranous and very thin or ſlender, yet a little increaſed by certaine circular and fleſhy fibres which it borroweth from the fleſhy membrane, and ſo ſtandeth halfe round in eyther lid. It ariſeth with a ſharpe beginning at the roote of the Noſe in the great and inward angle of the lower lid, where the common ſuture is betwixt the head & the vpper law, from thence it proceedeth all along the latitude or bredth of the lower lid and is inſtantly inlarged and returned to the outward angle toward the vpper part of the Orbe, and paſsing on by the vpper lid is inſerted with a ſharpe determination into the vpper ſide of the inner angle, and ſo maketh an exact circle compaſsing the outward circumference of both the lids; yet *Falopius* in his inſtitutions excepteth the inner part at the great angle, from which it is prohibited that it might not be altogether circular.

Bauhines deſcription of them.

The vſe of the orbicular muſcle.

The vſe of this orbicular muſcle is that being drawne toward his originall, it might at one and the ſame time moue the vpper eye-lid downeward, and the lower vpward, & ſo ioyne them and binde them both together. And that this is ſo it appeareth as well by the continuity of the fibres in the circumference and in the angle, as alſo by the motion of the ſame angle eſpecially if it bee a little more conſtrayned, ſo as wee muſt needes winke ſome thing withall, for then it is perceiued manifeſtly both by the ſight and by the touch. For nothing can be ſtrictly drawne together and made to touch one another vnleſſe ſome parts be drawne vpward and ſome downeward.

How it is ſaid to be double.

This muſcle in reſpect of his fibres which are continuall, is moſt truely ſaide to bee one, but in reſpect of the two lids may be called two ſemicircular muſcles, for being ſeparated they make each of them a halfe circle, but being ioyned they make the circle perfect.

This muſcle *Galen* knew, and in the 9 chapter of his 10 booke *de vſu partium* writeth that all the motions of the eye-lids are accompliſhed thereby. Hee diuideth it alſo into two, whereof one ſeated at the great angle draweth toward the noſe, the other (ſaith he) is ſeated at the leſſe angle and draweth toward the temples.

Moreouer in the traction of the firſt the lid is depreſſed; in the traction of the latter it is lifted vp, but becauſe the fibres of this muſcle are continuall through the whole lid it cannot be diuided.

Now

Now in the lower lid although it alſo be moued vpward and downeward, yet is there no Muſcle which hath *right* motion, but onely this forenamed orbicular muſcle which draweth it indeed vpward, but rather toward the inner angle or corner, as it wer to his beginning; as any man may perceiue by touching that part in himſelfe, and yet I know that ſome thinke this motion proceedeth from the motion of the cheekes.

How the lower Lid is moued vpwards.

We determine therefore and conclude, that the motion of the eye-lids is accompliſhed by two muſcles, one *right*, which being in the vpper lid eleuateth it, the other orbicular or round and is in both lids, which when it is ſtretched doth at the ſame time draw the lower lid vpwards and the vpper lid downward, and when there is need of a ſtronger contraction or cloſer ſhutting together, then alſo the orbicular muſcle of the eye-browes (of which we made mention before) is drawne in to be aſsiſtant, like as when we would open the eye more ſtaringly the muſcles of the forehead doe much helpe vs.

The concluſion cõcerning the Muſcles of the eielids

He that would demonſtrate theſe nice and curious Muſcles muſt haue a very keene and ſmall knife, wherewith he muſt ſeparate the skin, in the meane time taking care that he doe not cut the Fibres of the Muſcle, eſpecially in the angles; then ſhall he ſeparate the Muſcle below at the *Tarſus* or brimme of the lidde, and aboue in the bottome of the eye-brow.

Columbus & *Archangelus* add a third Muſcle which proceedeth ſay they out of the ſame place with the muſcle lifting vp the eyelid, which third muſcle is aſsiſtant vnto the former, becauſe there is required more helpe to lift a heauie thing vpward then to draw it downeward. But we ſay that this third muſcle of *Columbus* & *Archangelus* is indeed the ſixt muſcle of the eye.

Of the griſtle of the eielids called Tarſus.

We ſaide moreouer, that the ſubſtance of the eye-lids was cartilaginious or Griſtlye, hauing reſpect vnto their extremities or brimmes into which certaine ſemi-circular cartilages [Tab. 1. *aa*] like the hornes of a halfe-moone, round, ſmall and ſofte are inſerted betwixt the skinne and the ſmall Membrane which compaſſed the lid. Theſe the Grecians call ταρσοὺς, but *Plinie* and the interpreter of *Galen* cal them *Cilia*. *Hippocrates* in his book *De Videndicaie* calleth this Cartilage γονδρὸν.

Their Vſes.

Their Vſe beſide that which wee haue remembred before, is to helpe the motion of the eye-lids; for becauſe they ſtrengthen and firme the thin Membranes and holde them diſtended that they are not corrugated or wrinkled in their motion, it becommeth that the ſhutting and opening of the eye is equall.

Galen in the ninth chapter of his tenth Booke *De vſu partium* remembreth another vſe of them which is alſo approoued by *Veſalius* and *Falopius*, to wit, that the muſcle which is in the vpper lid might haue a more firme and ſtrong inſertion. The ſame vſe alſo it hath in reſpect of the haires of the eye-lids, which being eſtabliſhed in ſo firme a ſubſtance doe remaine right and immooueable which otherwiſe would haue falne vpon the eyes. And therefore *Galen* in the ſeauenth chapter of his tenth booke *De vſu partium* maketh this the ſecond vſe of the *Tarſus*, wher he alſo affirmeth that it is perforated with many ſmal holes which notwithſtanding *Platerus* denieth.

The haires of the Eie-lids.

The haires of the eye-lids [Table. 1. fig. 1 bb] are called by *Hippocrates in Coacis* βλεφαρίδες, as alſo by *Ariſtotle*. *Pliny* calleth them *Palpebræ a frequenti palpitatione*, becauſe they are often rubbed. The later Anatomiſts call them *Cilia quod oculos celent*, beecauſe they hide the eyes.

Their name.

They are borne with vs into the world, as are alſo the haires of the eye-browes and diſpoſed in an elegant order, keeping an equall magnitude and number, I ſay an equal magnitude: for ſayeth *Galen* in the 14. chapter of his eleauenth Booke *de vſu partium*, if you add any thing to them, or take any thing from them you corrupt or vitiate their Vſe, for if they bee fewer or ſlenderer there may ſome-thing fall thorough them to offend the Eye.

proportion.

The wiſedom of God.

Againe, if they bee thicker or groſſer, they are no more a wall or defence to the eye, but a priſon wherein the apple of the eye is hid and obſcured, which of all the Inſtruments of our ſenſes ha leaſtth neede of ſuch an obſtacle, and therefore ſaith *Galen* in the place before quoted, our wiſe Creator hath laide vpon them a lawe of neceſsity to keepe continually an equall magnitude, becauſe hee ſawe it was moſt fit ſo to bee for the vſe of that member for which they were ordained.

The maner of their poſition.

But wheras (and this is *Galens* obſeruation in the 7. chapter of his 10. book *de vſu partium*) it was moſt conuenient that the haires of the eye-browes ſhould couch or fal one vppon another, becauſe they were made to receyue that which fell from the Head before it could

come vnto the eye: theſe haires of the eye-liddes hauing another vſe were made to ſtand ſtraight, becauſe they ſhould better hinder duſt, flies, or any ſuch like things from falling in to the eyes.

Againe, they ſtand not ſtreight vpward to the browes nor directly downward to the cheekes, neyther do they bend inward to the eye; for if they had ſtoode ſtreight vpwarde their vſe had beene forfeyted for which they were created, and if they had ſtoode directly downward or beene bent inwarde they would haue beene a great hinderance to the ſight by breaking the continuity of the viſible obiects. Notwithſtanding as the haires of the vpper lid are bent a little vpward, ſo are thoſe of the neather lid curued downward, for if they had ſtood ſtraight out they would haue caſt a ſhaddow vpon the eyes and hindered our looking vpward.

and reaſon thereof.

In like manner there is a conuenient and as it were meaſured diſtance betwixt haire and haire: for if they had bin ſet one far from another many things might haue falne betweene them which now are intercepted, and if they had touched one another they would haue caſt too dull a ſhadow before the ſight. All which the wiſedome and prouidence of our great Creator hath by this excellent order and poſition auoyded. Theſe hai es doe neuer grow too long, neither do they euer fall, vnleſſe it be in extreame diſeaſes of that part, although *Ariſtotle* in the 11. chapter of his thirde Booke *De Hiſtoria Animal.* hath a conceite that the vſe of *Venus*, eſpeciallie if it bee to frequent will make them fall.

Their diſtãce.

Neither do theſe haires ſerue onely for ornament as ſome haue conceyued, but alſo to direct the viſible ſpirites and the beames which ſhoote foorth from the inner parts of the eye, for if they be falne away or retorted, a man can neyther ſee ſo directly forward, nor ſo farre off.

Their vſes.

Againe, their often twinckling recreates the ſight, and breaketh alſo ſomewhat the brightneſſe of the obiect, as wel as they intercept thoſe things which otherwiſe would fal into the eye, being placed as a Net to catch any thing that would ruſh into them.

Theſe eye-lids alſo haue veines from the Iugular veines; and Arteries from the *ſoporary* or ſleepy Arteies, Nerues alſo from the ſecond coniugation, all which veſſels do lead vnto them nouriſhment, heate and motion.

Their veſſels.

That which hangeth ouer the vpper eye-lid [Tab. 1. Fig. 1. 2. g.] *Ruffus* the Epheſian calleth κοῖλον, that is, the *hollow*: and that which anſwereth thereto vnder the lower lid is called ὑπόκοιλον, or *vnder the hollow*. Tab. 1. fig. 1, 2. h.] And this vſeth to ſwell in the Dropſie, the greene ſickeneſſe, a long fluxe of the Hæmorrhodes and of the courſes, ſometime alſo when the eyes begin to be bleared.

The bladders aboue and vnder the eyes.

It remaineth now that we add a word or two concerning the vſe of the eye-lids Although *Ariſtole* in the thirteenth Chapter of his ſecond Booke *de partibus Animalium* acknowledgeth no other vſe of theſe eye-lids, but onely to couer the eyes, and intercept thoſe things which would fall into them: and therefore ſaith that fiſhes haue no eye lids, becauſe they are alwayes in the water: nor ſhelly creatures becauſe the Mẽbrane of their eye is very hard, and beſide they ſtand deepe in their ſockets, yet we haue learned many other vſes of them which we will acquaint you with.

The vſes of the ey e-lids. *Ariſtotle.*

The firſt and chiefe vſe of the eye-lids therefore is, as *Varolius* well obſerueth, to cleanſe the hornie Mẽbrane from droſſe, for the ſight requireth an exact puritie in *medio diaphano* that is in his *tralucent meane*, otherwiſe we cannot ſee, eſpecially ſo diſtinctly, as appeareth in troubled water and ſmokie aire: wherefore becauſe the hornie coate by reaſon of the moiſture which ſweateth out of the glandule, as alſo by reaſon of the contaction of the outward aire is eaſily obtenebrated or darkned: the eye-lid was made compaſſed, that at once it might touch the whole eye, and therefore in opening the eye when the lid is lift vp, it ſweepeth and as it were poliſheth the whole horny coate or Membrane; and this is the reaſon why when we deſire to view a thing curiouſly we often winke with our eye-lids.

Varolius. The firſt vſe.

The ſecond vſe of the lids is, that the viſible vertue might ſometimes be turned from the light, eſpecially in ſleepe that a man might take the better reſt; and hence it is that in thoſe creatures which want eye-lids, as Locuſts, Lobſters, Crabs, & ſuch like inſectiles nature hath prouided certaine cauities, whereinto in the time of their repoſe as into certaine chambers they receiue their whole eies and ſhoote them out againe when they looke abroade, for ſhee hath an eſpeciall care of this, that euery ſenſe ſhould be kept fit to performe his owne action.

The ſecond.

And

And hence we may imagine the vnnaturall and cruell puniſhment which the *Carthagenians* inflicted vpon *M. Atilius Regulus*, whom in the firſt Punicke warre they had at vnawares ſurprized, who being by them ſent to Rome (after he had before taken his Oath to returne) did in the Senate-houſe diſſwade them from making exchange of captiues, wherefore when he returned they cut off his eye-lids and ſet him in the ſunne vntill the brightneſſe of the obiect ouer-came not onely the ſpirites of his Eyes, but alſo of his life.

A third vſe of the eye-lids is to recreate the ſight, leaſt at one time too great a number of ſpirits ſhould be exhauſted; for if the eyes ſhould be ſo long open as wee are awake, they would be wearied, and many things falling vpon their coates would offend them. Againe, if they be not quite ſhut vp they direct our ſight, if we deſire to take a true ayme at any thing which is ſomewhat farre off. The third vſe

Finally, they ſerue to defend the ſoft eyes from the incurſion of outward iniuries, becauſe it is much better ſometimes not to ſee at all, then by offering to ſee, ſuffer our eies to be offended. And thus much concerning the circumſtances of the Eies. Now we proceede vnto the Eye it ſelfe.

CHAP. IIII. *Of the Fat & Muſcles of the Eyes.*

THE parts wherof the Eye conſiſteth, are fiue Fat, Muſcles, Veſſels, Coats and Humors. The Fat which Anatomiſts do ſome of them call *Adeps*, ſom of them *Pinguedo*, is verie plentifull about the eyes [Tab. 1. Fig. 6. T] eſpecially it is found in thoſe ſpaces which are betwixt the Muſcles and the Nerues. It is alſo more plentifull at the vpper Muſcle, becauſe that is greater and ordained for more frequent & ſtrong motions. In like manner toward the lower ſide of the Orbe there is plentie of fat, which like a pillowe is laide vnder the Eyes, that with their weight they ſhould not preſſe themſelues vpon the bones. Againe, betwixt the Muſcles and the globe of the eie there is aboũdant fat, that when the Muſcles worke the eie ſhould not ſuffer compreſsion. Finally, there is alſo fat found neere the Veines and Arteries, whereby the veſſels are ſmeared ouer and their diſtention preuented in the motion of the eies. The partes whereof the eie is compounded. In what places of the eye the fat is ſolid

The vſe of the fat, in aſmuch as it is warme, is to heate the eye which by nature is wateriſh and cold, and beſide to defend it from the coldneſſe of the outward aire. And that is the reaſon why we neuer feele any manifeſt coldneſſe or ſtiffeneſſe in our eyes. Againe, the humidity of the fat doth moyſten the Muſcles, that they becõe not exiccated or dried vp in their often motions. The ſoftneſſe of the fat keepeth the eyes from being offended by the bones about them. The vnctuoſity or oyly fatneſſe maketh their motion ſwift and facile, and beſide, when the Muſcles are ſomewhat dried, becauſe of their motion and as it were conſumed, it affoordeth Aliment vnto them. The vſes of the fat.

The Muſcles of the Eyes, although they belong to another place, namely to the Booke of the Muſcles, yet becauſe wee are deſirous to abſolue the Hiſtory of the Senſes in this preſent Booke wee will take liberty to varry ſomething from our ſcope and ſet downe as perfect a deſcription of them heere as we can. And that was the reaſon why before we were ſo large in deſcribing the Muſcles of the eye browes and eye-liddes, concerning all which we will ſpare our labour and yours when wee come to the Hiſtory of the Muſcles. Becauſe therefore our eyes were giuen vs as ſpies and ſcout-watches that wee might purſue things profitable and eſchew that that is hurtfull, Nature made not the eyes immouable, for then they ſhoulde haue diſcerned onely that which is oppoſite vnto them, for ſo ſaith *Ariſtotle* in his ſecond booke *De partibus Animalium* and the tenth chapter *Cerimnus per directum*, that is, we ſee by a ſtraight line, not in euery poſition ſaith *Galen* in the eight Chapter of his tenth booke *de vſu partium*, becauſe oblique, ſide, backward, higher and lower Obiects do not fall in with the ball of the Eye. Nature therefore hath ſo diſpoſed the Eyes that they may moue & turn themſelues on euery ſide at their pleaſure. But *Galen* addeth in the place before quoted, that not only the eyes are moued but alſo the neck and the head are made mooueable for the behoof of the eyes, becauſe there are ſix poſitions of place vnto all which the eye ought to mooue; that is to ſay, vpward downeward, forward backward, on the right hand and on the left. Why the muſcles of the eye are deſcribed in this place. We ſee by a right line.

It was therfore of neceſsity that the eyes ſhuld haue other helps beſide their own motion, for the eyes are not mooued forward and backward, partly becauſe there was no abſolute neceſ-

neceſsity, and partly becauſe it was impoſsible; it was not neceſſary they ſhould moue forward ſayth *Aquapendens*, becauſe the eye doth not attaine vnto the light but the light vnto the eie, which in a moment enlightneth an infinite ſpace euen vnto the eie, yea inſinuateth it ſelfe thereinto.

But the wiſe Creator hath made amends for the defect of this motion of the eyes by the help of the motion of the head, which out of hād conuerteth it ſelfe to ſee thoſe things which the eie could not by his proper motions perceiue. Moreouer, that wee might ſee whatſoeuer is behind our backe (which could not be done onely by the circumuolutions of the head) Nature hath ſo prouided that the thighes can carry the body round. In like manner the motion of the eye vpward is aſsiſted by the backeward motion of the head and of the whols ſpine, which they haue experience of that ſtriue to take view of the pinnacle of a high Steeple: ſo alſo the motion of the eye downeward is furthered by that motion of the head and of the necke which is forward.

As alſo the motion of the thighes.

Seeing therefore it was neceſſary that the eyes ſhould bee moued with voluntary motion; and all voluntary motion is made by muſcles, therefore our wiſe Creator hath giuen vnto them diuers muſcles whereby their motions are very ſudden and expedite. Hence it is that *Ariſtotle* in the 8. Probleme of the 7. Section calleth the Eye *The moſt noble part of the body*: yet ſayth he, the left eie is more nimble then the right. Now whereas the motions of a mans eye are ſixe according to *Galen* in the third Chapter of his firſt Booke *de motu muſculorum*, it followeth neceſſarily that the eie muſt haue ſixe muſcles; but *Galen*, *Veſalius* and the reſt of the Anatomiſts as *Columbus* ſayth, being accuſtomed only to deſcribe the eies of beaſtes haue added a ſeauenth muſcle, and thoſe ſixe alſo which they haue deſcribed they haue miſplaced. But we are to deſcribe the muſcles of the eye of a man; that ſeauenth which belongeth to beaſtes is deuided into two, into three, and ſometimes into foure.

Why their muſcles are many.

In men therefore as we haue ſaid there are ſixe muſcles according vnto the ſixe motions of a mans eie; foure of which motions are *Right*, that is to ſay vpward, downeward, to the right hand and to the left; the two motions remayning are oblique, to which belong two oblique muſcles whoſe vſe is to rowle the eie about. Notwithſtanding one of theſe is exactly *oblique*, the other partly *right* partly *oblique*. All theſe muſcles are ſeated on the backeſide of the Eye within the cauity of the Scull, whether they accompany the opticke nerue and ſo remayning in their poſition, the eie and they together doe make a Pyramidal or turbinated figure. [Table 1. figu. 6. 7.] Among theſe muſcles the thicker and more corpolent are the *Right* which haue all the ſame ſtructure, originall and inſertion, and do paſſe ſtraight al along the length of the eie; the oblique muſcles are leſſe fleſhy yet very like one another.

Why ſixe,

How many motions the eie hath.

The figure of the eie.

All theſe muſcles of the eie are ſmall that they might be ſooner mooued; but that which helpeth moſt the volubility of their motion is the round figure, which is the nimbleſt of all others, as we may perceiue by the roundnes of the heauens.

Why the muſcles are ſmall.

The eie therefore being round as are alſo the muſcles thereof, is euen in a moment conueyed ouer the whole heauen, and the head it ſelfe is therefore mooued very ſuddanly and ſwiftly, becauſe it toucheth vpon the bone whereon it reſteth with a narrow point.

Why round,

The foure *Right* muſcles meeting and touching one another toward the roote of the nerue optick, doe ariſe with a ſharp beginning frō the lower part of the bony orbe which is made by the wedge bone, hard by the paſſage through which the nerue of ſight or the opticke nerue doth yſſue. I know well that *Veſalius* is of opinion that they ariſe out of diuers parts and into diuers parts are inſerted. Againe for their matter, he conceiueth they ariſe from a commixture of the *Dura mater* which compaſſeth the opticke nerue and a nerue of the ſecond coniugation. *Platerus* thinkes that they ariſe from the membrane which compaſſeth the orbe of the eye, and that membrane which inueſteth the opticke nerue. *Aquapendens* imagineth they proceed from the *Pericranium* or Scull-skinne. *Laurentius* diſputeth about their originall on this manner; They erre, ſaith he, which thinke the muſcles of the eie doe ariſe from the inner thicke membrane which compaſſeth the opticke nerue, for this is altogether againſt ſence; they could not ſayth hee ariſe from a membrane nor they ought not. They ought not, becauſe a membrane of an exquiſite ſence compaſſeth the nerue, which nerue the muſcles in their motions would compreſſe, and ſo the ſight would be offended. They could not becauſe they are not eſtabliſhed vppon a firme foundation. It remayneth therefore, ſaith *Laurentius*, that they muſt ariſe from the inmoſt depth of the

The right muſcles.

Diuers opinions about their original

orbe

Table 2. Figure 1. ſheweth many muſcles of the Eye in their owne ſeate.

Figure 2. ſheweth the Eye rowled vpward whereby their muſcles may be perceiued.

Figure 3. and 4. ſheweth the muſcles of the Eye, ſeparated before and behind with their nerues.

Figure 5. Is the Eye of an Oxe, with his muſcles ſeuered as Veſalius doth ſhew it.

TABVLA. II.

FIG. I.

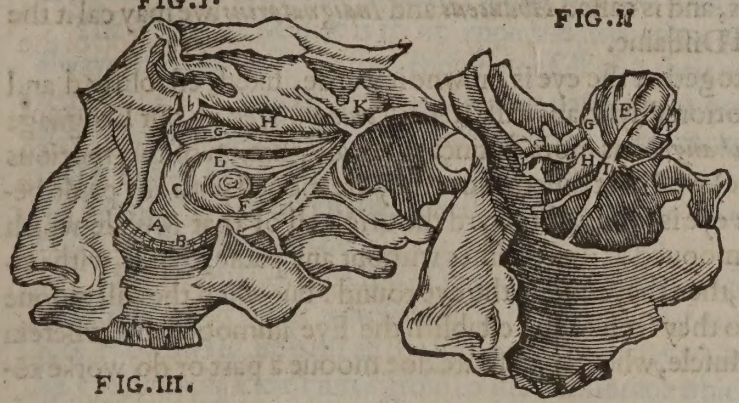


FIG. II.

FIG. III.

FIG. IV.

FIG. V.

A, The eie-lid. B, The *Tarſus* or griſtle where the haires grow.

C, the muſcle lifting vp the eye-lid.

D, 1, 3, 4, the right vpper muſcle of the eie in 3, and 4, with the nerue.

E, 2, 3, 4, the right lower muſcle of the eye, in 3 and 4 with the nerue,

F, 1, 2, 3, 4, the right externall muſcle of the eye.

G 1, 2, 3, 4, the right internall muſcle of the eye.

H, 1, 2, 3, 4, the oblique ſuperior muſcle or the pulley, whoſe tendon is marked with *a* and the pulley with *b*.

I 2, 3, 4, The oblique inferior muſcle of the eye.

K 1, 3, the opticke nerue.

a 1, 2, The tendon of the oblique ſuperior muſcle.

b 1, 2, the ſayd pulley, a ſmall griſtle where through the tendon doth paſſe, & in the 3 and 4 pulled from the bone.

cccccc 3, 4, the mouing nerues of the eies.

αβ, 5, the ſecond muſcle of the eye-lid lying in the cauity of the eye, whoſe broad tendon *β* is inſerted into the eie-lid.

γ 5 the haires of the eie-browes.

δε 5, two right muſcles leading the eie vpward and downward.

ζη 5, Two right muſcles mouing vnto the right and left ſide.

Bϑ 3, 5, two oblique muſcles lightly turning the eye.

κ 5, the ſeauenth muſcle which may bee deuided into more.

λ 5, The Opticke nerue.

orbe or cauity. But we reſt vpon *Bauhines* opinion for their originall.

Their whole bodies throughout their whole courſe are fleſhy, and their bellies beare out round as they come forward. But they determine a little aboue the middle of the eye into a broad thinne and membranous tendon wherewith they compaſſe the whole eye before, and grow very ſtrongly to the horny Tunicle neare vnto the *Iris* or Raine-bow in the greater circle: and theſe tendons ioyned together doe make that nameles coate of *Columbus* and the white of the eie. Their inſertion,

For we conceiue that this whiteneſſe is cauſed rather by the tendons of theſe muſcles then that it properly belongeth to the coate which we call *Adnata*. And ſo much ſhal be ſufficient to haue ſpoken in generall of the muſcles of the Eie. Now we come to a more particular diſcription of them one by one. Whence the whitenes of the eie proceedeth.

The firſt [Table 2. figure 1, 3, 4. [b] fig. 5. [δ]] which is the third according to *Veſſalius*, and *Galen* alſo in the 8. Chapter of his 10. Booke *de vſu partium*, is ſeated aboue; fleſhy it is & round, thicker alſo then the reſt, greater and ſtronger then the ſecond, becauſe it lifteth the eie vpward toward the brow. For there is greater ſtrength required to lift a thing vp, then to pull it downe. The names of this muſcle commonly giuen by Authours are, *Attollens* and *Superbus*, the *Lifter* and the *Proud* muſcle. A more particular deſcription of the ſeuerall muſcles.

The

The ſecond which according to *Galen* and *Veſalius* is the fourth [Table 2. figure 2,3,4. E. figure 5.ᵉ] is oppoſite vnto the former and placed in the Lower part; it draweth the eye downeward to the Cheeks, and therfore needed not be ſo great as the former, becauſe the eye declineth eaſily with his owne waight. It is called *Deprimens* and *Humilis*; the *Depreſſor* and *Humble* Muſcle.

The third [Ta.2.fig. 1,2,3,4ᶜ. fig.5,ᶜ] according to *Galen* and *Veſalius* the firſt, is ſeated in the great angle and leadeth the eye inward toward the noſe, and is called *Adducens* and *Bibitorius* we may call it the Gleeing Muſcle.

The fourth [Tab.2.fig. 1,2,3,4ᶠ. fig. 5, ᶠ] which according to *Galen* and *Veſalius* is the ſecond, is oppoſite to the third, ſeated on the outſide of the eye which it draweth to the leſſer angle or to the temples, and is called *Abducens* and *Indignatorius*, we may cal it the Scu-muſcle or the Muſcle of Diſdaine.

Their Vſe. If all theſe foure worke together the eye is drawne inwarde, fixed, eſtabliſhed and conteined, which kind of motion Phyſitians call *Motus Tonicus*, wee in our Language cal it a Set or wiſt-looke. *Archangelus* is more diſtinct in the aſsignation of the motions of theſe Muſcles, for (ſaith he) whē as at diuers times they are moued with any pauſe betwixt their motion, then the eye is mooued toward the originall of that Muſcle which worketh. But when they are mooued at diuers times without any pauſe, that is, with immediate ſucceſsiue motions, then they mooue the eye round: but when they all mooue in the ſame moment then do they ſet fixe and eſtabliſh the Eye immooueable, wherein they are holpen by the fift Muſcle, whether all foure doe mooue a part or do worke together.

The fifth [tab. 2. fig.2,3.4.ᵗ fig. 5.ᵗ] which is alſo according to *Galen* and *Veſſalius* the fifth, but the ſixth according to *Fallopius*, *Platerus*, and *Laurentius*; is ſeated in the outſide at the depth of the cauity and ariſeth betweene the eye and the Tendons of the ſecond and fourth Muſcles; which is the reaſon why ſome haue thought that it taketh his originall from the Eie and is againe inſerted into the ſame. But the very place of his originall is at that cleft which appeareth like a ſuture or ſeame of that bone of the lower part of the Orbe which ioyneth the firſt bone of the iaw with the fourth. Sometimes it ariſeth with a fleſhy beginning from a bony ſcarfe. It is ſlender, round, ſhort and exactly oblique, and paſſeth obliquely toward the outwarde angle as it were to embrace the eie, and is implanted with a ſhort and round Tendon, degenerating into a thinne and Neruous termination neere vnto the *Iris* or Rain-bow but obliquely, hard by the inſertion of the ſixt Muſcle, ſo that ſometimes the Tendons of them both, ſerue one and the ſame.

To recite heere the contentions and challenges of Anatomiſtes about this Muſcle would rather entangle our Readers minde then giue him any great ſatisfaction, eſpecially ſeeing thoſe learned men to whom ſo nice diſquiſitions will not ſeem tedious, may repaire to thoſe fountaines from whence we haue drawne our by-ſtreame, and therefore we paſſe on to the vſe which is by the contraction of his Fibres to rowle the eie oblique ly downward to the outward angle.

His original. The ſixt [Tab.2.fig. 1,2,3,4.ᴿ fig.5.ᴿ] which is the ſixt alſo according to *Galen* & *Veſalius*, but the fift according to *Falopius*, *Platerus* and *Laurentius*, is ſeated on the inſide and the vpper part, yet vnder the right Muſcles, and is partly right and partly oblique. It ariſeth from the ſame place with that Muſcle which draweth the eye directly vnto the inner angle at the ſide of the Opticke Nerues paſſage, which is in the verie depth of the Orbe.

His end or Tendon. It endeth as well in man as in bruite beaſtes into a round, ſmall and long Tendone, [Tab.2.fig.1,2.ᵃ] almoſt at the vtmoſt brimme or edge of the inward angle. This Tendon is reflected through a ſmall griſtle hollowed like a Caue and ſcituated in the greater angle, which *Fallopius* firſt of all men called *Trochlea* or the Pully, & thence proceeding obliquely to the right angle [Ta.2,fig.2,ᵇ but in the thirde and fourth figure it is ſliuen from the bone] toward the vpper part of the eye, it is inſerted betweene the firſt and the fifth Muſcles with an oblique line, all which time the foreſaid Tendon is compaſſed about with a certaine Ligament as it were with a ſheath.

His progreſſe. *Falopius* his *Trochlea* or pully.

His inſertion.

This Muſcle being drawne inward toward his originall with his Tendon he turneth the eye in a circular motion to the inward Angle. Theſe two turning Muſcles the one vpwarde the other lower are called *Circulares & Amatorij*, the rowling or glauncing Muſ-

Muſcles, ſome alſo call the ſixt *Muſculum Trochleæ*, or the Muſcle of the pully.

The ſeauenth Muſcle which is for the moſt part found in brute beaſtes, excepting the Ape and Fiſhes, is placed [Tab. 2. fig. 5. κ] vnder the former ſixe, and hath of it ſelfe that figure which the former ſixe do together make. It is ſhort and compaſſeth round about the Opticke nerue, [Tab. 2. fig. 5. λ.] yet is their ſome fat betweene them. Proceeding forward it is dilated and embraceth the whole globe of the eye euen to the roote. It maketh alſo a circle like as the foure firſt did at the *Rainbow* make a circle with their chords or Tendons: at his inſertion, which is into the hard tunickle of the eye, it becometh fleſhy and may be diuided into three or foure; ſo as *Galen* in the fourth chapter of his fift booke *de diſſectione Muſculorum* maketh a doubt whether it be one Muſcle, or double or treble. The 7. belonging to a beaſt.

The vſe of this Muſcle is to tie vppe and ſtrengthen the eyes of brute beaſts hanging alwayes downeward, that they ſhould not fall with their own weight. It alſo incompaſſeth the nerue Opticke therby making his paſſage, not only ſtraight but alſo warranteth it frō diſtention & frō leaning againſt the bone in violent concuſsions or ſuddain motions. *Galen* addeth in the booke before named, that in that motion which we called *Tonicall* or the fixing of the eye, it eſtabliſheth the ſame when we would accurately diſcerne any ſmall body; for he ſuppoſed this Muſcle alſo to be in men.

But Nature or the God of Nature rather, did not ſee it needfull for mankinde, becauſe his countenance is erected vp to heauen, and if at any time hee bee conſtrained to looke downward, he hath all the foure right Muſcles with their ioynt ſtrength to ſuſtaine his eye, becauſe their Fibres grow to the Membrane which compaſſeth the Orbe. Why a man hath not the 7. Muſcle.

Falopius addeth an eight Muſcle found in Oxen which draweth that griſtly Membrane which *Ariſtotle* in the twelft chapter of his ſecond booke *de hiſtoria Animalum* calleth the *skin of the angle*, with which Membrane brute beaſts do blinke when they feare leſt any thing ſhould fall into their eyes: vnleſſe any man ſhall thinke this is a part of that Muſcle which draweth the eye to the outward angle.

To finde out theſe Muſcles of the eye, when the Braine is taken away you muſt cut the Orbe at each corner euen to the Opticke nerue with a ſaw, hauing a great care leſt the Trochlea or pully which is in the inner angle be offended. How to make diſſection beſt to find out theſe Muſcles

Next you muſt ſeparate the *Pericranium* from the bone, and bend the vpper part of the Orbe backeward, then take away the fat and ſo ſhall you perceiue the Muſcles of the eye-lids, and of the eyes themſelues together with their veſſels; and if you would obſerue the proper and peculiar motion of euery Muſcle, you muſt preſerue them in their proper poſitions and tie to euery one of them a thred not farre from the Tendons, then draw the thred and the draught thereof will deſcribe vnto you the vſe of the Muſcle to which it is tied.

You may alſo take the eye whole out of his Orbe together with the Trochlea, which is in the inner angle, and ſo demonſtrate what you pleaſe. And thus much ſhall bee ſufficient to haue ſpoken of the Muſcles of the eyes. Now we proceede vnto their veſſels.

CHAP. V. *Of the veſſels of the Eyes.*

FOr the ſame reaſon for which we intreated preciſely of the Muſcles of the eye in their Hiſtorie, we will alſo handle their veſſels more diſtrictly in this place, and paſſe them ouer more lightly in the booke of Veſſels. The veſſels are here fully handled.

The veſſels therefore which are ſent vnto the eye are veines and Arteries, to which are added Nerues, as being cōmon Organs no leſſe then the other. Veines.

The Veines which are ſent vnto the eye proceed out of the iugular Veines & leade blood for their nouriſhment.

The Arteries ariſe from the *Carotides* or ſleepy Arteries, and are diſperſed through the muſcles to moderate the inward heate, and to ſuſtaine their life; through which Muſcles as alſo through the fat they are accompanyed with Nerues, and diſtributed through their Membranes, which is ſhewed in the third Table the ſecond and third figures at [h]. Arteries.

The Nerues are of two ſorts, *Optici* and *Motorij*, that is, *ſeeing* and *moouing*; they proceed out of the marrow of the braine yet remaining within the ſcull and making the ſpinall marrow. Nerues.

The Opticke Nerue [tab. 2. fig. 1 and 3. [x]. fig. 5. λ. tab. 3. fig. 2. 4. 8. α.] which is called *Viſorius* or the Nerue of ſight, is on each ſide one, and theſe are amongſt all the nerues of ſenſe the largeſt, the thickeſt, the ſofteſt, and *Galen* alſo ſaith the longeſt in the third chap- Opticke.

ter

ter of the ſixteenth book *de vſu partium*. They are of a rare texture cõpaſſed with both the Meninges. [tab. 3. fig. 2. [a b c].] They are the greateſt and thickeſt of all the Synewes, that ſo aboundant faculty might be tranſported to the eye, that it might ſooner haue ſenſe of the light, and be manifold wayes affected.

Why the greateſt and thickeſt.

They are very ſoft ſaith *Galen* in the fifth chapter of his ſeuenth book *de placitis*, that they might be ſooner affected becauſe they are nerues of ſenſe and of a ſenſe ſo very neceſſary, for all ſenſe is perfected by receiuing and ſuffering. They are ſofter then any other, becauſe they are affected by the light alone, which they receiue alſo very much broken. They are the longeſt of all the reſt, becauſe the way is long from their originall to the Orbe of the eye. Their texture is rare and thin, and therefore *Herophilus* beleeued that they were perforated: and *Galen* thereupon called the πορους and *meatus viſorios*. For in the third chapter of his ſixeteenth booke *de vſu partium*, hee noteth out of *Herophilus*, that they are in their inſide perforated all along their paſſage, and that perforation was the reaſon why they were made ſo large.

Why ſofter.

Galen out of *Herophilus*.

By theſe *Galen* thinketh not onely that the faculty of ſenſe is tranſported, but alſo the Animall ſpirits in which the faculty is eſtabliſhed, that ſo their ſenſe might be more aboundant and ſtrong: whereas through other Nerues he conceiueth that the vertue or faculty onely is carryed as we may perceiue in the 12. chapter of his tenth booke *de vſu partium*, and in the fifth chapter of his ſeuenth booke *de placitis*. Theſe Opticke nerues in their end and in their originall are diſtinct, but at the middle of their progreſſe aboue the ſaddle or ſeat of the wedge bone, before they fal out of the ſcul becoming a litle broader, the right is vnited with the left [tab. 21. lib. 7. fig. 1. [o o]] ſo that they make the forme of the Greeke χ, not by cleauing the one to the other, or by intercuſſation, or that one rideth ouer the other, but by perfect and abſolute vnion and confuſion of their marrowes they are ſo ioyned that one cannot be ſeparated from the other, [tab. 21. lib. 7. fig. 1. [x]] for it is a very rare thing in Anatomie to find them ſeparated.

Where they are diſtinct. Where vnited.

The vſes of their coniunction.

The vſe of this coniunction is, partly that the *Pupilla* or ſight of the eye might look vpon the ſame plaine leaſt otherwiſe the viſible obiects ſhould appeare double becauſe the eyes are double: partly that the *Idea* or formes of viſible things might be vnited and ſo the faculty of ſight be common to both ſides, becauſe the viſible ſpirit may paſſe from one eye to another in a moment for the more certainty of the ſight: And this is prooued if we preſſe or inforce one eye vpward or downward, for then all things appeare double: wherfore as it was conuenient that the eyes ſhould be pararels; ſo alſo the nerues, which becauſe of the motion of the eyes might decline from the right line, eſpecially ſeeing the muſcles do compaſſe them and cleaue vnto them: for when one muſcle onely whether it be the vpper or the lower is moued, the eye alſo is rowled to one ſide. And therefore Nature hath worthily ioyned the Opticke nerues together, that euen in ſuch motions the faculty might be wholly conuaied to either ſide. And this appeareth to be true becauſe if you put your hand betwixt your eyes along the length of your Noſe, ſo that you cannot ſee the obiect you intend with both eyes, you ſhall perceiue that you ſee more obſcurely on either ſide, then if you lookt vpon the obiect with one eye ſhut vp, for then the faculty which was before diſperſed vnto both, is vnited into one. Adde alſo this third profit of the coniunction, that the ſoft nerues hauing a long way to go, might thus be made ſtrong and eſtabliſhed, becauſe Nature could not ſuſtaine them with any ties or knots of Membranes. After their coniunction they are inſtantly diſioyned, and each nerue iſſueth through the proper hole which is framed in the depth of Orbe out of the ſcull [Tab. 21. lib. 7. fig. 1. aboue [x].] and ſo the right attaineth to the right, and the left vnto the left eye, and there are implanted.

In a man they are inſerted on the backeſide into the center of horny coate [ſee the third table fig. 2. 3. 4. 8.] becauſe onely man can look directly forward. In brute beaſts as in oxen and horſes, whoſe eyes are much farther a ſunder, they attain by a line notably oblique vnto the compaſſe of the eye and do not determine in the Center. Hence it is that the eyes of brute beaſts doe ſee the earth on either ſides to direct their gate and to finde out their nouriſhment. Theſe Opticke nerus when they are come vnto the eies are dilated ſaith *Galen* in the 1. chap. of his 10. book *de vſu partium* and like a membrane each of them in cõpaſſe the glaſsie humor *Galen* alſo addeth in the ſame place that they are inſerted into the Criſtalline humour.

The vſe of the optick nerues

The vſe of theſe Opticke nerues is to leade the viſible faculty from the braine which in the

the eies is gathered vnto the visible formes, where the Nerue is dilated into the Membrans of the eie. For if this Nerue be obstructed as it is in that disease which the Arabians call *Gutta serena* the cleare drop, the action of seeing is altogether taken away or intercepted. And so much concerning the Optick Nerues. *Gutta serena.*

The Nerues of Motion are on either side one, which sendeth a small sutele to eache Muscle by which it is mooued [Tab. 2. fig. 3. 4. sheweth this] (as he may perceiue who diligently shall separate the beginning of the Muscles from the Nerue) which also is spred abroad into the Membranes. These mooving Muscles in their originall are continuall, that is, the right is ioyned with the left, whence it commeth to passe that when one eye is mooued the other also followeth the same motion: for they proceede ioyntly out of one point as it were in the fore-part of the spinall Marrow, so that the same obiect and the same light, after the same manner and at the same time insinuateth it selfe into either eye, that the sense and discerning might be one and the same; and this maketh much to the perfection of the sense that one and the same thing might not appear double, which doubtlesse would happen if one eye might be mooued vpward and the other downward at the same time. That this is true you may easily learne if with your finger you either depresse or lift vp one of your eyes, for then all obiects will appeare double, one higher another lower. But if you mooue your eye toward the side, because the *pupilla* or *Sightes* are in the same line, the obiects will not seeme double. Wherefore *Galen* in the thirteenth chapter of his tenth booke *de vsu partium* writeth, that the Diameters of the visible Cones must be placed in one and the same plaine, least that which is one do appeare double. The Nerues of motion. Where they are continual Demonstrations hereof.

Hence it is, that in the palsye and convulsion of the Muscles of the eye the patient often seeth double Obiects, because the eyes do depart from the same plaine. So also when the Opticke Nerues are either conuelled or relaxed the *pupilla* or *Sight* not beeing in the same line, all thinges appeare double, which also for the same cause happeneth oftentimes to men when they are drunke.

From these Instrumentes Veynes, Arteries and Nerues are deriued vnto the eye; aboundance of Spirits Natural, Vitall and Animall, which are properly called visible spirits: wherfore acording to the plenty of the Spirits conteyned in the eyes, their magnitude as also their splendor or brightnes is greater or lesse. And hence it is that whē men are nere their death their eyes becom litle, languid & obscure, as also those that do too much follow venerial combats haue their eyes smal and extenuated, so also wee see that in liuing men the eyes are full and turgid, but when they are deade they become lesse as also laxe and rugous, for the presence and absence of the spirits maketh a difference betwixt a liuing and a dead eie. The spirits of the Eies.

Againe, according to the diuers disposition of the spirites and of the eyes from them, we are able by our sight to distinguish and iudge oftentimes of the affections of the mind, which is a cleare argument and euen liable to our sense, that the body of a man is ful of spirits, which thing *Galen* also in the tenth booke *de vsu partium* prooueth by an elegant and demonstratiue argument. For (saith he) if vpon the closing of one eye you do attentiuelie marke the *pupilla* or sight of the other, you shall perceyue it in a verie moment to be dilated, because a greater quantity of spirits do fall into the Grapie coate which we call *Vuea*, through that coate which is called *Reticularis* or the Nette, where they dilate the hole of the *Vuea*, which hole is properly called *Pupilla* or the sight and Apple of the eye. Finallie, that the eyes are full of spirites is hence conuinced, because they are sometimes obscure, dull and languid or weake, sometimes bright or shining, quicke and apprehensiue. But least these spirites which are of an admirable fineneſſe and subtiltye might exhale or euaporate they are kept in and retained by a thick, thight and strong Membrane which is called the Horny coate. Diuers argumentes to proue there are spirites in them.

CHAP. VI. *Of the Membranes of the Eyes.*

HAuing declared the Muscles & the vessels of the eies & now remoued them away, the eye it selfe round like a bowl appeareth [Ta. 2. fig. 3 & 4. Ta. 1. fi. 2 & 3] which may be compared to the world & an egge, both for the figure & construction. To an Egge which consisteth of Membranes, the shel which is an indurated Membrane & a thin Membrane vnder it, & humors, the white & the yolke: So the globe of the eye hath membranes & humors. Membranes that being of a watery nature it might better be conteined in his positiō and the humors by them encompassed, which membranes had need to haue a more solid The eie compared to an Egge.

 substance, be-

substance, beside they are a great furtherance to the sight: Humours onely for the sight.

The Membranes of the eie.

Concerning the number of the Membranes the authors are at great difference. *Hippocrates* in his Booke *De Locis in Homine* acknowledgeth but three, the vppermost thick, the middlemost thinner, and the third thinnest of all which conteineth the humors; but in his booke *De Carn.* he saith they are manie. The later Grecians reckon four, *Siluius* fiue *Vesalius* sixe, *Galen* in the seuenth chapter of his tenth book *De vsu part.* seuen; vnto whō *Fuchsius* & *Aquapendens* do consent. We wil diuide them into two kinds, some are common to the whole eie, some are proper to the humors; the common Membranes are the *Cornea* and the *Vuea* the horny and the grapie coates. The proper Membranes are the Cristaline and the glassye. But whereas there are commonly reckoned seauen, *Adnata*, *Cornea*, *Dura*, *Vuea*, *Choroides*, *Aranea*, and *Retina*, whereto some haue added those which are called *Vitrea* and *Innominata*, we wil runne thorough them al after our Anatomical order.

Their number verie diuerse according to authors,

First *Adnata.*

The first is called *Adnata* which is the seauenth according to *Galen* in the second chapter of his tenth booke *De vsu partium*, so called as it were *Nata circa oculum*, bred about the eye. *Galen* cals it ἐπιπεφυκὸς, because it cleaueth on the outside of the other mẽbranes of the eye, whereupon it is also called *Adherens* or the cleauing Membrane. This is the vtmost. *Aquapendens* supposeth that it ariseth from the *Periostium* & tendons or chords of the Muscles. It first offereth it selfe before Dissection together with the transparant part of the horny Membrane lying vpon the white thereof.

Whence commeth the white of the eie.

The *Periostium* is alwayes next vnto the bone, vnlesse it be wher it produceth the eyelid, for hauing therto attained it maketh an angle & so is doubled, one part of which duplication compasseth the lid of the eye, the other part [Ta.1.fig.6,7,8,V] maketh this *Adnata* or adhering Membrane, which becomming thinner in the fore-part only where the white of the eye appeareth, couereth the same and determineth or endeth in the greater circle of the *Iris* or *Rain-bow*, where it is continued with the hornie Membrane. [Tab.1. fig.7,8. V. and Tab. 3.fig.1 d]

It is said to be white from the colour, although saith *Aquapendens* it be not indeed white but onely appeareth so, because the Tendons of the Muscles lying vnder it do represent a kind of whiteness. But *Hippocrates in Coacis* calleth it λευκὸν, the white of the eye. It is a smooth Membrane, and by the interposition thereof the eye is fastned to the orb and to the inner bones, and it serueth instead of a Ligament to all the bones about the eye. Hence it is called commonly *Coniunctiua a Coniungendo*, because it ioyneth together all the Membranes of the eye, thereby making it firmer and stronger, or rather because at the *Iris* or *Raynbow* it is ioyned to the rest of the Membranes.

Coniunctiua.

The vse of the *Adnata.*

In like manner it tieth the eie to eie-liddes and to the head, and in a worde it defendeth the eie from the hardnesse of the bones, it ioyneth it with the bones, the liddes, and the rest of the coats, whereby it is so established that in violent motions it doth not fall out of his orbe, but is freely mooued; and besides it couereth the Muscles which mooue the eie and keepeth them in their proper seates but because it hath rather the vse of a Ligament then of a Membrane, we thinke it approacheth nearer to the nature of a Ligament.

The vessels of this coate.

This coate or Membrane or Ligament whither you list to cal it, is sprinkled with manie smal Veines [Tab.1.fig.6.7.8. V] and Arteries, which commonly when the eie is in perfect health do not appeare. Sometimes they grow verie red and being ful of bloode they strut therewith and so become more conspicuous as in the inflammation of the eie. For as *Hippocrates* hath it, sometime this white groweth red or blackish, or is ful of black Veines; this Membrane or coat it is which communicateth to the eie the sense of Touching, because neyther without nor within it hath any sense at al, and therefore the pain which proceedeth from the eye-liddes molesteth the Eye onely by reason of this Membrane.

The 2. Coate *Innominata.*

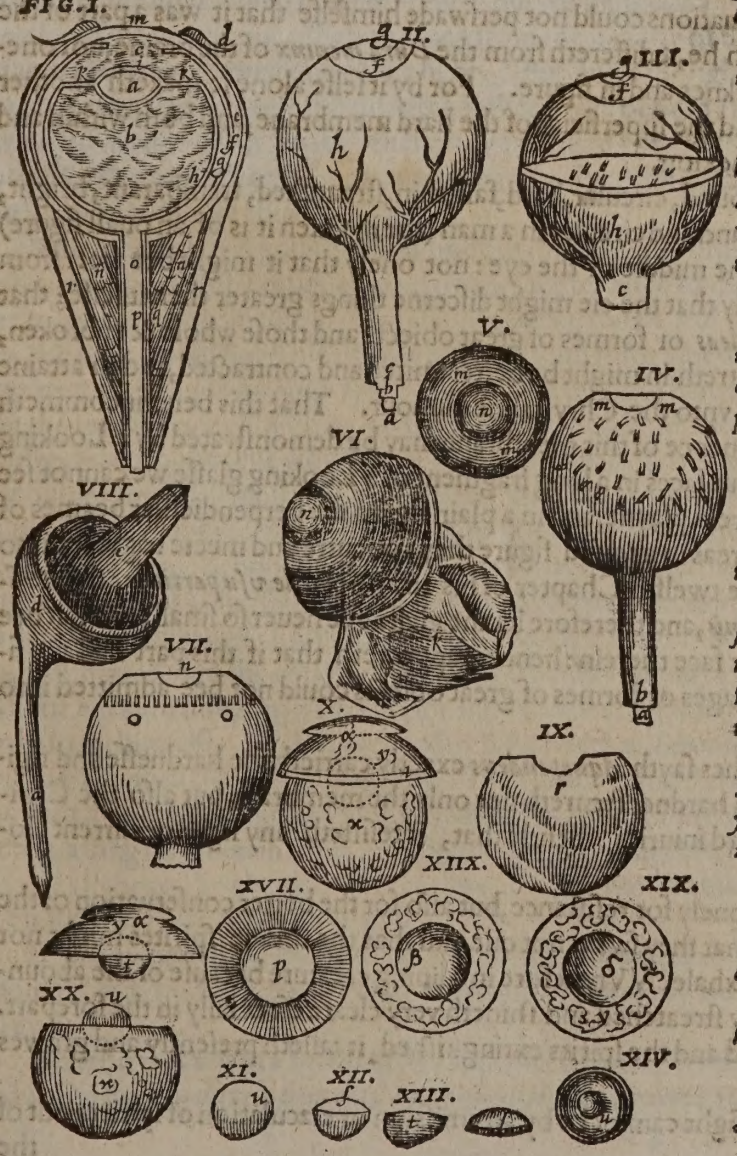
The second Coate of the Eye is called *Innominata* by some, as if it had bene but newly found out, whereas *Galen* knew it wel enough, and in the second chapter of his Tenth booke *De vsu partium* reckons it for the sixte Membrane. It ariseth from the Neruous Tendons or Chords of the Muscles and determineth neere the Iris vnder the *Adnata* or Coniunctiue Membrane; and these Tendons do encrease the whiteness of the eye, because they haue a bright *Candor* or whiteness. But being nothing lesse then the Chords

of

Table 3. Figure 1. sheweth the Membranes and humors of the eye by lines drawne after the manner of a true eye.
Figure 2. Sheweth the horny coate with a portion of the Optick Nerue.
Figure 3. sheweth the same diuided by a transuerse section.
Figure 4. sheweth the Vuea *or Grapy coate with a portion of the Opticke Nerue.*
Figure 5. The Grapie coate of a man.
Figure 6. The Horny, Grapie, and the Choroides.
Figure 7. The interior superficies of the Grapie coate.
Figure 8. The Posterior part of the horny coate together with the saide Net separated from the Eye.
Fig. 9. The coat of the vitreous or glassy humor cald Hyaloides.
Figure 10. Three humors ioyned together.
Figure 11. The forward part of the Cristalline.
Figure. 12. The Cristalline humor couered yet with his Coate.
Figure 13. The Cristalline bared on the sides.
Figure 14. The Cristalline of a man.
Figure 15. His Coate.
Fig. 16. The watery, disposed vpon the Cristaline round about.
Fig. 17. The hairy processes beaminglie sprinkled through the foreside of the coate of the glassy humor.
Figure 18. The foreside of the glassy humour.
Figure 19. The place of the watery humour.
Figu. 20. The glassy humour conteining or comprehending the Cristalline.

TABVLA. III.

FIG. I.



The explication of the first Figure by it selfe.

a. The Cristalline humour.
b. The Glassy humour.
c. The watery humour.
d. The vtmost coate called *Adnata*,
e. the dark part of the horny Tunicle which is not transparant.
f, the Grapy coate called *Vuea*.
g, the Net-like coate called *Retiformis*.
h. the coat of the glassy humor cald *Hyaloi-*
i, the coate of the Cristalline. (*des.*
kk, the hairy processes cald *Processus ciliares*
l, the impression of the Grapy coate where it departeth from the thick coate.
m, the horny coate, a part of the thick coate
nn, the fat betwixt the Muscles,
o, the Optick Nerue,
p, the *Dura Meninx*.
q, the *Pia Mater* or thin Meninx.
rr, The Muscles,

The explication of the other 19. figures togither

a, 2,4,8. The Optick Nerue,
b, 2,4. The thin *Meninx* clothing the nerue
c, 2,3. the thick *meninx* clothing the Nerue.
d 8, the posterior part of the horny Coate.
e 8, the coate called *Retina* gathered togeather on an heape.
f, 2,3, the Raynbow of the eye.
g, 2,3, the lesser circle of the eie or the *pupilla*
h, 2,3. Vessels disperfed through the *Dura Meninx*.
i, 3,6. the Grapy coat, but *i* in the 3. Figure sheweth how the vessels doe ioyne the hard membrane with the Grapie coate.
k, 6. the horny or hard membran turnd ouer
ll, 3,4. Certaine fibres & strings of vessels, wherby the grapy coat is tied to the horny.
mm, 4,5. the impression of the Grapie coate where it recedeth or departeth from the horny coate.
nn, 4,5,6,7, the *pupilla* or Apple of the eye.
oo, 7, The Ciliar or hairy processes.
p, 7. The beginning of the grapy coat made of a thin membrane dilated, but *p* in the 17. figure sheweth the Ciliar processes sprinckled through the fore-part of the glassy humour.
r 9, the bosom or depression of the glassye humor receiuing the Cristaline. (line
s, 12,15, the bredth of the coat of the crista-
t, 12. 13, 14, 16, the *posterior* part of the cristaline humor which is spherical or round.
u, 11, 14, 20, the fore-part of the same Cristalline depressed,
x, 10, 20, the amplitude of the glassy humor
y, 10, 16. 19, the amplit. of the watry humor
z, 10, the place where the glassy humour is distinguished from the watry by the interposition of the *Hyaloides* or coate of the glassy humor.
α, 10, 16, the place where the grapie Coate swimmeth in the watrie humour.
β, 18, The Cauity or depression of the glassy humor which remaineth in the Cristalline is exempted or taken from it.
δ, 19. The cauity or depressiō of the watry humor made by the same meanes.

of the muſcles, it cannot bee properly called a membrane but a part of the muſcles, which together with them muſt needs be demonſtrated, notwithſtanding if any man liſt to ſtand vpon it and call it a membrane we will not gainſay him.

The vſe of it, The vſe of it is, that by the interpoſition thereof the muſcles might bee more fitly inſerted into the horny membrane [tab. 2. fig. 5. ſheweth the ſame.

The 3. coate *Cornea*. The third coate of the eie is called *Cornea*, which is the firſt according to *Hippocrates*, and may well be called the thicke and hard coate both in reſpect of his ſubſtance and of his originall, becauſe it is produced from the hard Meninxe or the *Dura mater* which inueſteth the opticke nerue. And here we may take knowledge of the admirable wiſedome of our Creator, who (as *Galen* hath excellently obſerued in the 2. Chapter of his tenth Booke *de vſu partium*) whereas in no other place hee hath ſeparated the Meninges from any Nerue which are produced with them, but hath led them along with the nerue that they might be nouriſhed & couered; only in this place after the nerue is inſerted into the eie, hath ſeparated both the thicke and the thinne from the nerue it ſelfe; yea made them thicker and harder then they were when they encompaſſed the braine. For when this membrane is implanted into the backpart of the eye [Table 3. figure 3. c] it is dilated and maketh an orbicular or round membrane [Table 3. figu. 2 and 3. exhibite it] which compaſſeth the whole eie, although it bee not in euery place alike, neither haue one and the ſame name; for the forepart is tranſlucid but the backepart is not ſo; wherfore ſome immitating the Arabians of this membrane how made two. For becauſe the ſight did ſtand in need of tranſparencie, this membrane, when it hath attayned vnto the middle of the forepart of the eie iuſt againſt the Criſtaline humor, it is ſo condenſed that it degenerateth into a horny ſubſtance, which forepart [Table 3. fig. 1. cm] is called *κερατοειδὴς Cornicularis* that is Horny, becauſe in the middle as farre as the extent of the Rainebowe it is like a thinne and polliſhed horne of a Lanthorn, not only in tranſparencie by which meanes it receiueth the light, but alſo in his ſubſtance, becauſe it may be ſliuen or deuided into diuers flawes. And that was the reaſon why *Fallopius* in his obſeruations could not perſwade himſelfe that it was a part of the hard membrane becauſe, ſaith he, it differeth from the *Dura meninx* of the braine, not onely in ſubſtance but alſo in thicknes and in figure. For by it ſelfe alone it maketh another ſpherical cauity ariſing beyond the ſuperficies of the hard membrane, and both within and without is free from any connexion.

How it is ſpred ouer the eie.

Why it is compared to a horne of a Lanthorne.

Fallopius his opinion.

The forme & diſpoſition thereof. This horny membrane is round, circular, hard, faſt, thin, ſtreatched, tranſparant, bright, polliſhed and ſmooth. Round and circular in a man (for in Oxen it is of an ouall figure) bunching or bearing out in the middle of the eye: not onely that it might bee freer from being offended: but eſpecially that the eie might diſcerne things greater then it ſelfe; that is, that it might receiue the *Ideas* or formes of great obiects and thoſe whole & vnbroken, as alſo that the light which entreth in might be better vnited and contracted, and ſo attaine through the *Pupilla* or Apple vnto the Chryſtaline humour. That this benefit commeth by the roundneſſe and prominence of this membrane may be demonſtrated by a Looking glaſſe, for if we deſire to ſee our faces in a long fragment of a Looking glaſſe we cannot ſee them whole, becauſe the figure is playne, and in a plain figure the perpendicular beames of the light are not vnited: whereas in a round figure they concutre and meete together into a poynt: for *Galen* ſayth in the twelfth Chapter of his 10. Booke *de vſu partium*, that *Viſion* or *Sight* is made by a *Pyramis*, and therefore let the glaſſe bee neuer ſo ſmall, yet if it bee round wee may ſee our whole face therein: hence it appeareth that if this part had any figure ſauing a circular, the images or formes of great obiects could not bee admitted into the eie at all.

Why round & circular,

Why hard. It is hard and in ſome Fiſhes ſayth *Aquapendens* exactly carrieth the hardneſſe and rigidity of a horne it ſelfe. This hardnes ſecureth not only the membrane but alſo the Chriſtaline humour from outward iniuries: beſide that, it reſiſteth any light occurrent violence.

Why faſt. Faſt and thight it is, not onely for reſiſtance, but alſo for the better conſeruation of the watery and glaſſie humours that they ſweat not out, and that the thinne ſpirites might not penetrate through it and ſo exhale. Wherefore in a liuing creature becauſe of the abounddance of ſpirites, it is notably ſtreatched and ſhineth very cleare eſpecially in the forepart. But when the creature is dead and the ſpirits extinguiſhed, it falleth preſently and growes looſe and corrugated.

Hence it followeth that ſight cannot be by an emiſsion or eiaculation of ſpirites out of the

the eies, becauſe the tention or ſtreatching of a liuing eie proceedeth from no other cauſe but from the aboundance of ſpirits concluded and contayned within this membrane. And although it be the firſt and next part of the eie which is expoſed to all iniuries of cold, heat and whatſoeuer elſe might fall vppon or bruiſe the eye; yet by the wiſedome of Nature it is defended by the lids, by the haires, by the bones and by the skinne. Moreouer it is not a ſimple or ſingle membrane but made as it were of many ſhels or ſcales, vpon which ſayth *Ruffus* in the fift Chapter of his firſt book, there is a cuticle or curtaine ſpread which is far thinner then the reſt of the ſcales, that if haply one of them ſhould be gnawne aſunder, the reſt might ſuffice to contayne and defend the Chryſtaline humour. *Auicen* maketh it fourfould.

It is very thinne, for, ſayth *Galen* in the third Chapter of his tenth book *de vſu partium*, if it had been thicke it might indeede haue beene a defence vnto the eie, but it would haue caſt a perpetuall darke ſhadow vpon it, and would haue hindered the paſſage of the light; whereas now being thinne it tranſmitteth any light or brightnes freely and without delay ſo that the chryſtaline humour may diſcern the true purtraitures and repreſentations of all viſible obiects; wherefore alſo it is tranſparant, cleare and bright becauſe it ſhould be more fit for the tranſmiſsion of illumination, for ſo we ſee that the thinner a horne is the better doth the light extend it ſelfe through it. Why thin.

It is alſo ſtreatched, for if it had beene corrugated or wrinkled and ſo vnequall, it muſt needes haue loſt his roundnes, ſmoothnes and tranſparancie; and ſo the ſight would haue beene much hindered. An experience whereof wee haue in old men in whome this membrane is ſometimes ſo rugous and looſe, that either they can ſee nothing at al or very confuſedly, for, ſayth *Aquapendens*, when one plight or fold falleth vpon another and the coat thereupon is duplicated, the membrane becomes thicker & the Apple contracteth it ſelfe becauſe it is not diſtended by a ſufficent afluence of ſpirits. Why ſtretched.

It is tranſparant that it might giue way to all viſible formes and repreſentations, and alſo admit the light which beateth vpon it. But we muſt conſider that this tranſparancie or lucidity of the membrane differeth much from the lucidity of the aire, that ſo there might inſue a refraction or breaking of the light. But howe the light paſſeth vnto the eye and how it is refracted, becauſe it belongeth rather to the opticke Art then to Anatomy; him that liſteth to be further ſatisfied therein, we wil ſend vnto the writers of the Opticks, ſuch as are *Vitellius* and *Alhazen*. *Aquapendens* alſo the Anatomiſt hath elegantly written of theſe things of the eie: but we proceed. Why tranſparant.

This membrane is polliſhed and ſmooth that in it the formes of thinges might better ſhine and more fitly be receiued, and images repreſented to the chryſtaline humour moſt like to the outward obiects. For if it had beene rough and full of eminencies and cauities, the light would not haue equally attained vnto it; for where cauities are there doe the repreſentations paſſe through more eaſily and brighter; where there is any eminencie ther doe they paſſe through with more difficulty, and beſide are very obſcure. Moreouer ſuch an aſperity or roughneſſe would haue beene troubleſome to the eie-lid, as wee ſee it happeth when any ſmall ſubſtance falleth betwixt the eye and the lid. But being faſt, hard & thinne, it could not receiue any veines into it, neither yet arteries nor nerues: neither if it could had it beene behoofefull, for they would haue hindred the ſight, & although it might haue defended the chryſtaline humour from outward offences, yet it would haue been offenſiue to the ſight with his hardneſſe: and finally it would haue abated the viſible faculty communicated vnto the eies from aboue, and haue dimmed or dulled their brightnes. For that the eyes are offended with a bright and vehement light, euery man hath ſufficient experience in himſelfe. Beſide, we read in hiſtories that *Zenophons* ſouldiours were almoſt blinded by trauelling through the ſnow. And *Dioniſius* that Tyrant of *Cicilia* aboue his priſon built a very lightſome and bright chamber which he whitened ouer with lime, & when he had a long time detained his priſoners in a darke dungeon, hee ſuddenly brought them into this light and bright place, where they inſtantly became blinde becauſe their eies were not able to beare ſo ſudden a change. Why poliſhed and ſmooth. That much light is an enimy to the ſight. *Dyoniſius* his cruelty.

In like manner thoſe that doe labour of the *ophthalmia* or inflamation of the eye are offended with the light: but duskiſh or greene colours they are able to behold without offence. The greater light extinguiſheth the leſſe.

Hence it is that if in a bright light a man would looke on any thing that is a far off, he will hould his handes or ſome other thing ouer his browes to ſhadow his eies that they

be not dazled. So alſo it hath bene obſerued, that thoſe that haue fixed their eyes vpon the Sunne to behold the Eclipſes of the ſame, haue vtterly loſt their ſight. And this commeth to paſſe, euen as we ſee a torch or candle lighted and ſet in a bright Sun is inſtantly extinguiſhed: In like maner if you light a candle and ſet it by a great flame, the candle will preſently go out, becauſe the leſſe light is ouercome and diſsipated by the greater.

After the ſame manner in the eye, not onely the ſpendor of the Criſtalline humour, but with it alſo the brightneſſe of the glaſsie humour is diſsipated: wherefore the wiſe and prouident Creator, ſaith *Galen* in the third chapter of his tenth booke *de vſu partium*, hath interpoſed the coat called *Choroides*, which in many parts is black and duskiſh, and in oxen green; which coate nouriſheth the horny coate that is next vnto it where they touch one another, and hindereth it alſo from falling vpon the Criſtalline humour, although that inconuenience is in part preuented by the roundneſſe and prominence of the ſaide horny coate.

The wiſedom of our Creator acknowledged by *Galen*.

Moreouer, the blacke colour of the *Choroides* in men, and the green colour in Oxen, is a medicinable curtaine or ſhadow for the ill affected eye; and this is the reaſon that euery man by a naturall inſtinct, when he is offended with the brightneſſe of the light, will ſuddenly cloſe his eye-lids, making haſte thereby vnto the remedy which Nature hath prepared, euen within the eye. And this may be further exemplified by the cuſtome of Painters, who when they paint vpon white tables would ſoone haue their eyes offended if they did not prepare againſt it, wherefore they place at their elbowes greene and duskiſh colours, vpon which euer and anon they turne their ſight, whereby their eyes are recreated and refreſhed.

The backe-part of the horny coate.

The poſteror or backeward part of this coate which couereth the back part of the eye and the forepart alſo vnto the circle, [Tab. 1. fig. 7. 8. f] is hard, thicke, darke, or obſcure; differing as much from the colour or cleareneſſe of the horny membrane, as the white of an Egge when it is boyled differeth from the ſame white when it is raw. It is hard and thicke by reaſon of his originall, although it neither imitate the exterior coate of the nerue in thinneſſe, nor the *dura meninx* or thicke membrane of the braine from which that ariſeth in thickeneſſe; as being fourefold thicker then it, for when it formeth the coate of the eye it is thickened and hardned, for it was requiſite it ſhould be very hard and very thicke for more ſtrength, becauſe it maketh the whole globe and cauity of the eye wherein the humours are contained; for this membrane it is which faſhioneth the figure of the eye into a globous roundneſſe, and in that figure conſerueth it: it is alſo made whole, for this coate aboue compaſſeth the whole eye ſo that nothing can iſſue therout.

Why it is ſo thicke.

Add hereto that it receiueth the inſertions of all the muſcles & ſuſtaineth their weight, as alſo the weight of the fat and is a Baſis or foundation of the veines and arteries [Tab. 3 fig. 3. h h.] which neare the nerue behinde the glaſsie humour attaine vnto this membrane and afterward run forward till they be diſtributed through the coate called *Choroides*. By the mediation of theſe veſſels, as alſo by ſmalties, as it were by ligaments this membrane cleaueth ſo faſt to the *Choroides*, that they hang one vpon another. [Tab. 3. fig. 3. h i.] The profit of which connexion is, leſt this coate alone ſhould be mooued when the other parts of the eye are at reſt, as we ſee a cloth wrapped about a ſmooth bowle will eaſily ſlippe, though the bowle be not moued.

Why it is thicke and darke.

This membrane is alſo thicke and darke or obſcure, that the *ſpecies* or formes of things which are receiued might ſhine more brightly, as we ſee in a looking glaſſe if it be leaded on the backe ſide we my eaſily ſee our faces therein, but not ſo if the lead be remoued. This part is white, and neither in nature nor in colour like vnto the forepart, and therefore ſome of the late writers as *Fuchſius* and *Aquapendens* haue diſtinguiſhed it from the forpart, and ſay, that the limits and edges therof are continuated with the horny membrane. It is ſcituated vnder the Coniunctiue and Tendons of the muſcles, and is generated out of the *dura meninx* which compaſſeth the Optick nerue, for with it it is continuall, as may be perceiued if you ſeparate the coate of the nerue with a ſharpe knife through his length whileſt you come vnto this membrane. It is called by ſome σκληρότης & σκληροτικὴ the *hard* membrane, *Ruffus* calleth it *candida* or the white membrane, although commonly that name be giuen to the *Adnata* or Coniunctiue coate.

Fuſchius, *Aquapendens*.

Ruffus.

The vſe of this third membrane.

By the heple of this membrane is the eye eſtabliſhed, as alſo the next membrane vnto it defended, which is ſufficient indeed to defend that which is vnder it, but not to defend it ſelfe: this alſo is it which containeth the humors according to their due diſpoſition;

ſition; and whereby the Criſtalline humour it ſelfe is preſerued from the cold and heate of the Ambient aire.

CHAP. VII. *Of the Grapie Membrane, the Apple, Rainebow and the Ciliar Ligament.*

THe fourth coate or Membrane of the eye is called by the Greekes ῥαγοειδὴς and ῥώξ; in Latin *Vuea* or the Grapie Membrane, becauſe the colour of it is like the peele of a Grape ſtone or kernell, or it is like the kernell it ſelfe which is on the outſide ſmooth, but within ſharpe and rough; in like manner this Membrane on the outſide which is next the horny Membrane is ſmoth but on the inſide which is next the Criſtalline it is rough or rather vnequal becauſe of the ſurcles of veins and arteries which reach out of the hornie Membrane into it. [Tab. 3. fig 3 and 4.ll.] Again it reſembleth the Grape kernell in the colour which is blacke, or rather becauſe it containeth a whitiſh humour ſuch as iſſueth from the grape when the ſtalke is pulled off.

The 4. coate of the eye.

The reaſon of the name.

His ſcituatiõ.

This Membrane is ſcituated betwixt the *Cornea* and *Retina* vppon which it lieth onely on the backeſide, but forward it is betwixt the *Cornea* and *Aranea* and containeth the waterie humour of the eye. [Tab. 3. fig. 1.c.] It is tyed backeward to the Opticke nerue, and the coate called *Retina*: to the hornie membrane it adhereth by certaine ſurcles of veines and arteries [Tab. 3. fig. 3.] and to the ranibow by Fibrous ties which are not very ſtrong. Before it is euery way free and looſe, that it might be contracted and dilated.

His figure.

The figure of it is not exactly Globous as the former, becauſe it doth not compaſſe the whole eye, but in the forepart [Tab. 3. fig. 4.mn. fig. 7. atn.] it is a litle preſſed inward, where alſo it is perforated with a round hole.

His originall.

The originall of this coate *Galen* ſaith in the ſecond chapter of his tenth booke *de vſu partium* is frõ the *Pia mater*; [Tab. 3. fig. 1.f. fig. 4. and 5.] for when the *Pia mater* or thin Membrane hath inueſted the Opticke nerue, [Tab. 3. fig. 2. b.] it is preſently dilated vnder the *Cornea* to make this Membrane: wherefore it creepeth forward and compaſſeth the whole eye, excepting the forepart where at the greater circle or rainebow of the eye, it is continued with the *Cornea*, & being reflected backeward is duplicated and in the mid perforated, which perforation is called *Foramen vueæ*. the hole of the grapy membrane and by a proper name *Pupilla* which we may interpret the Apple of the eie. Notwithſtanding it is farre thicker then the *Pia mater*, eſpecially in the forepart where it is double as thicke as it is behind. Againe, it differeth from the *Pia mater* in colour, for the coate of the Nerue which it receiueth from the *Pia mater* is white, but this is blacke on both ſides.

Why it is called *Choroides*.

Moreouer, becauſe it proceedeth from the *Pia mater* or thin membrane, it is called alſo χοροειδὴς eſpecially, becauſe through it there are many veſſels diſſeminated, & becauſe like the Chorion of the wombe it gathereth thoſe many veſſels and tieth them together; and this in oxen is eaſie to be diſcerned, for in them the veſſels do run through the length of the eye in a conuenient diſtance one from another, from which veſſels certaine threddy filaments or ſmall ſtrings do as it were weaue together this membrane like as it is in the *Pia mater* of the braine. From this membrane alſo the foreſaid ſtrings and threedy veſſels are produced into that coate which wee call *Retina* as may eaſily bee perceiued when this Grapy membrane is ſeparated therefrom.

This Grapy coate therefore is full of veines, ſoft, black, and perforated.

His veſſels.

Why it is ſoft

Full of Veines, that it might nouriſh the horny membrane: ſoft that it might not hurt the Cryſtaline humor, and beſide might readily moue when the *Pupilla* or Apple moueth, which it would not ſo readily haue done if it had beene rigid or ſtiffe.

Why blacke.

It is blacke or rather duskiſh, the better to gather the brightnes of the *Idea* together, and to tranſmit it through the perforation.

Why perforated.

Finally, it is perforated iuſt againſt the Cryſtaline humour, that ſo the Images of viſible things paſsing through the horny membrane and wateriſh humour might at length ariue at the chriſtaline. And although it be moyſt and ſoft and neare neighbour to the chryſtaline, yet is it not offenſiue thereto; albeit on the outſide it be ſomething thicke or rather faſt wrought: for as it was fit that this membrane ſhould not offend the chryſtaline humor, ſo likewiſe was it as fit that it ſelfe ſhould not be offended by the horny membrane; betwixt the tranſparant part whereof and the chryſtaline humour it is ſeated, and yet it toucheth neither of them.

Further

Furthermore, that the chryſtaline humour might not bee offended or touched by the horny coate inſinuating it ſelfe through this hole or perforation, by which the externall brightnes attayneth vnto, and is mingled with the internall; Nature hath ſet that part of the horny membrane outward, and beſide hath diſpoſed about the Chryſtaline a thin and cleare humor like the white of an egge; and laſtly hath filled the whole perforation with an ayery and bright ſpirit. And that this place hath ſuch a thinne moyſture and is ful of ſpirits is hence manifeſt, becauſe in liuing creatures the eye is ſtreatched & fulfilled on euery ſide, no part of the horny membrane remayning looſe or corrugated.

What is contained betwixt the grapy membrane and the chriſtaline humor.

But if you looke into the eye of a dead man before you come to diſſect it, you ſhal find it rugous, and when you haue cut the horny membrane preſently a thinne humour wil offer it ſelfe (which alſo in compunctions of the eye doth vſually yſſue from the wound) and ſo the whole eye will become rugous, contracted and looſe. Againe, if you diſtend and ſtreatch the coates when they are ſeparated from the chryſtaline humour, it will appeare that there is a great diſtance betwixt them emptie, which while the creature was aliue was vndoubtedly filled vp with ſpirits or humour or both

The like alſo may be demonſtrated in a liuing eye, for if one eye be ſhut the *Pupilla* or Apple of the other will bee dilated, inlarged and diſtended as a bladder that is blowne vp; what then ſhould diſtend or inlarge this *Pupilla* or perforation, ſayth *Galen*, but onely a ſpirit? And this indeed is his argument whereby he proueth that there is an Animall ſpirit.

The ſpirits of the eie.

For, ſayth he, this amplification or inlargement hapneth becauſe al the ſpirits doe aſſemble themſelues vnto the eye which is open, whereas when they are both open the ſpirits are equally diuided betwixt them. *Galen* alſo prooueth the ſame thing by diſſection; for if you blow vp the grapy membrane on the backſide you ſhall perceiue that the *Pupilla* or perforation will bee inlarged. VVherefore it followeth neceſſarily that all that ſpace which is before the chriſtaline humour is filled with ſpirits and a thinne humour. The thinne humour ſheddeth it ſelfe in all the other parts but in the very *Pupilla* or perforation the ſpirits are gathered togeather.

The *Pupilla* or Apple of the eie.

This *Pupilla*, is called κόρη by *Hippocrates* in his Booke *de Carnibus*; by *Galen* in the fourth Chapter of his tenth Booke *de vſu partium* [Table 3. figure 4.5.6.7.ª] In Latin *Pupilla*, *oculi feneſtra*, the window of the eye, *nigrũ oculi & foramen oculi*, we vſe to call it in our language the Apple of the eye.

It is a hole or perforation of the grapy membrane and is otherwiſe called the leſſe circle of the eye (as the greater circle is called the Rainebow) [Tab 3. figure 2.3.ª] becauſe it appeareth in the center of the eye like a blacke poynt. Blacke (I ſay) as well becauſe of the deepe ſcituation, as alſo becauſe the coates which compaſſe it about are of a darke colour. This hole or perforation is not onely leſſe then the compaſſe of the horne, but alſo there is ſome diſtance betwixt them, leaſt otherwiſe the ingreſſe of viſible images through the horne might be interrupted; wherefore when the grapy membrane commeth to the tranſlucent part of the horny membrane, it is no more round but reflected backeward and incli-neth toward the chriſtaline humour, leauing a hole in the middeſt which is called *Pupilla*, as *Varolius* hath elegantly deliuered.

The figure of it.

This *Pupilla* or Apple of the eye is in man and ſome other creatures as Dogges very round: in many bruite beaſtes, as Oxen, Sheepe and Goates it is longer then round, of an Ouall figure or like a circle compreſſed in the middeſt, which compreſsion is dilated or contracted according to the motion, either proceeding from the Animall ſpirite, or from the light: ſo that the figure thereof is ſometimes round, ſometimes long, ſometimes wide, ſometimes very narrow, as in a Cat whoſe *Pupilla* is like a narrow and long cleft; *Aquapendens* ſayeth, that in a Pike it is of the figure of a cone.

How the *Pupilla* is contracted & dilated. *Galen.* *Aquapendens.*

The dilatation and contraction of this *Pupilla* or Apple of the eye, *Galen* aſcribeth to the Animall ſpirits, but *Aquapendens* thinks that the hole of the *vuea* or grapy membrane, (which is al one with the *Pupilla*) is dilated or conſtringed acording to the ſtrẽgth or weakneſſe of the light that beateth vpon it. For in a ſtronger light it is contracted the better to defend the chryſtaline humour, which is oftentimes offended by a ſtrong light. In a leſſer or weaker light it is dilated to helpe the ſight to diſcerne of many viſible thinges, which otherwiſe would not appeare; (And therefore thoſe that complaine of the weaknes of the eyes and ſight muſt haue them viewed rather in an obſcure and darke, then in a Lucide or bright place) and ſo it commeth to paſſe that a ſtrong light doth not offend the eyes, becauſe it is admitted to the chryſtaline humour in a leſſe quantity; nor a weake proue inſuffi-

cient

cient becauſe it is receyued in a greater quantitie.

That the motion of the *Pupilla* is not from the Animall ſpirite as from the efficient cauſe he prooueth, becauſe a ſtrong light attenuateth the ſpirits, diffuſeth them, and ſo ſhould conſequently enlarge the *Pupilla*. On the contrary, a weake light doth dull & diminiſh the ſpirits and ſo the *Pupilla* ſhould be ſtraitened, whereas common experience teacheth vs the quite contrary: wherefore ſaith *Aquapendens* I conceiue that the dilatation and contraction of the Apple of the eye proceedeth from a proper faculty of the the Grapy coat, which Faculty notwithſtanding is ſtirred vp by the external light which entreth into the eye, and yet we ſee that in Suffuſions and Catarracts the *pupilla* is dilated and conſtringed when a ſtrong light cannot offend ſuch eyes becauſe it hath no free paſſage, the Catarract or clowd being interpoſed betwixt the light and the ſight: howbeit euen in ſuch Suffuſions if one eye bee ſhut the *pupilla* of the other is dilated, which can be from no other cauſe but onely from the ſpirits.

Obiections againſt *Aquapendens*

The vſe of this perforation or *pupilla* is to tranſmit the viſible images to the Criſtaline humour: for (ſaith *Galen* in the fourth chapter of his tenth booke *De vſu partium*,) vnleſſe the Grapy coate had heere bene perforated all the parts of the eye had bin created in vaine, becauſe the Criſtalline humor hath no communion with his obiectes but onely by this perforation of the grapy Membrane, and therfore according as this apple of the eye is dilated or contracted, ſo do we ſee better or worſe. And hence it was that *Galen* in the ſecond Chapter of his firſt booke *de ſymptomatum Cauſis* hath well obſerued that the dilatation of this Apple of the eye, whether it be an original fault in Nature or happen after by accident, is alwayes a great weakner of the ſight. On the contrarie, the coarctation or ſtraightning of the *pupilla* if it be naturall is the cauſe of the quickeneſſe and vigour of this ſenſe, for when it is notably dilated the animall ſpirit which floweth into the eye cannot fill the whole ſpace which is before the Criſtalline humor; whereas on the contrary when the *pupilla* is contracted or gathered together the ſpace is ſooner fulfilled.

The vſe of the *Pupilla*.

A narrow apple is the beſt ſight.

And why

Add heereto that for the perfection of ſight it is very neceſſary that the viſible ſpecies or Formes ſhould flow vnto the eye by a right line and ſo paſſe vnto the Center of the Criſtaline with a pointed angle; for ſo they make the better impreſsion, and therfore the perforation or the *pupilla* is very narrow that the lines produced from the Circumference thereof as from a baſis might touch the center of the Criſtalline in an acute angle; for if the *pupilla* be ſo dilated that the lines produced from the circumference thereof do make a right or obtuſe angle in the center of the Criſtalline then is the ſight not onely offended but aboliſhed.

Hence it appeareth that the naturall latitude or ſtraightneſſe of the *pupilla* maketh much for the ſtrength or weakeneſſe of the ſight, eſpecially if the diſtance betwixte the viſible obiect and the organ of the ſenſe be proportionable. But to return vnto the grapie Membrane, of which this apple of the eye is but a perforation.

This Membrance according to the difference of the parts thereof hath diuerſe colours, for on the outſide where it toucheth the horny Coate it is blacke; on the inſide where it reſpecteth the watery and Criſtalline humours it is black or duskiſh. But where it maketh the greater circle which we call the Rain-bow (according to the diuers temper of the Braine and the eyes ſaith *Laurentius*) it is ſometimes greeniſh, ſometimes sky coloured, ſometimes blacke. Finally, the backward part of this Membrane where it firſt ariſeth from the *Pia mater* is whitiſh, preſently it groweth greeniſh, then nearer vnto a blewe, all which colours may be beſt diſcerned in the eye of an oxe. This black colour (as *Galen* in the third chapter of his tenth booke *de vſu partium*, where hee ſpeaketh of a sky colour becauſe he deſcribed the eie of an Oxe) is very worthy of admiration, becauſe there is no ſuch colour found elſe-where in the whole body. And although in ſome eies it is leſſe or more blacke then in others, yet in all it is eyther blacke or browne, that the criſtalline humour being therewith couered might better collect and gather his brightneſſe together. For as a ſmall light in an obſcure and darke place is better perceiued & ſhines brighter then in an open and light place, and maketh thoſe thinges which are about it better to be perceyued; ſo the brightnes that is encluded within the eye becoms more bright, and the viſible ſpecies do better appeare in the criſtalline humour, becauſe the inner circumference of the whole eye is inueſted with this obſcure and darke Membrane, by whoſe ſhadow the criſtalline is compaſſed; ſo that his brightneſſe returning backe

Diuers colors of the Grapie Membrane.

What profite the eie hath by his blacke colour.

How the colour of the inside differeth from the colour of the out side.

backe from the blackeneſſe and obſcurity of the membrane is vnited better into himſelfe. And ſo (as *Aquapendens* hath well obſerued) that light which is but weake, or but moderately ſtrong doth better appeare in the Chriſtalline then that which is much ſtronger, as whereby the inbred light of the humour it ſelfe is ouercome.

Againe, we ſay that the darkeneſſe of the colour of this membrane maketh much to the collection and refection of the ſpirits. For when the Criſtalline is too much affected by a vehement light, then we cloſe our eyes and the ſpirits turning themſelues vpon thoſe darke colours are refreſhed, as before hath bene ſhewed in our Hiſtorie of the horny membrane. Wherefore alſo about the *pupilla* it is thicker, becauſe it ſhould caſt a greater ſhadow vpon the Criſtalline in that place where the light hath his acceſſe, for on the backeſide it is compaſſed with the thicke and faſt horny coate. And for this cauſe betwixt the horny membrane and the Criſtalline humour this coate is blacke. But this blackeneſſe on the inſide of the coate where it reſpecteth the humours, ſeemeth to bee bred with the coate it ſelfe, but on the outſide where it reſpecteth the horny membrane, I conceiue it is but accidentary becauſe it wold colour a mans finger that toucheth it, and may eaſily be waſhed of ſo that the membrane will remaine white; but the colour on the inſide will not die or taint the finger, for if it were ſo thoſe bright bodies which it reſpecteth and compaſſeth would be foyled by that blackeneſſe, and ſo looſe their purity.

Some are of opinion that this blackneſſe is the thick excrement which is ſeparated in the nouriſhment of the Criſtalline humour, as alſo that the watery humor is the thin excrement of the ſame. Now as this blackeneſſe is perpetuall in all creatures on the outſide of this coate; ſo on the inſide, eſpecially where it reſpecteth the glaſsie humour, the membrane is ſometime browne, ſometime purple or skie coloured (whence it was that *Galen* in the fourth chapter of his tenth booke *de vſu partium*, called it a skie coloured coate) and ſometimes greene as in oxen; but where it is perforated on the foreſide and reſpecteth the ſhining or tranſparent part of the horny Membrane it is not in man of one and the ſame colour; yet ſo that it is alwayes of that colour which we ſee in the Rainbow of the eye, according wherto we ſay a man hath blacke or browne, or skie coloured, or a Goates eye, which ſaith the Phyloſopher is an argument of a good diſpoſition: ſo that the ſame *Ariſtotle* in the fifth booke *de generatione Animalium* and the firſt chapter hath well obſerued that among all creatures onely man hath eyes of diuers colours, for other creatures all of the ſame kind haue eyes alike, excepting horſes, who ſomtimes haue wayle eyes.

A mans eyes of diuers colours.

The Rainbow of the eye.

The Rainebow which appeareth in the clouds, becauſe this greater circle of the eye]Tab. 1. fig. 7. 8. f. Tab. 3. fig. 2. 3. f.] is diſtinguiſhed with diuers colours which ſhine through the horny Membrane. *Galen* in the ſecond chapter of his tenth booke *de vſu partium*, ſaith, that in this Rainebow there are ſeuen circles one within another, all differing in thickeneſſe and colour, which proceed from the Membranes. But how nice a peece of buſineſſes it were in diſſection to offer to ſhew all theſe circles diſtinctly without confuſion, ſurely ſo hard a matter it were to accompliſh as vaine when it were performed. Some haue called this *Iris* στέφανη a *Crowne*.

A nicitie in diſſecuon.

Diuers opinions of the cauſe of the Rainbow.

There are many opinions of the cauſes of ſo great variety of colours in this circle of the eye, and if you will giue me leaue I will acquaint you with what other men haue conceiued, and then deliuer that opinion which I follow my ſelfe.

Empedocles, Ariſtotle.

Firſt of all therefore *Ariſtotle* in the firſt chapter of his fifth booke *de generatione animalium* maketh mention of *Empedocles* his conceit, who compoundeth the eye of fire and water. The skie coloured eye ſaith he, is when the fire beareth the ſway, and the blacke eye when the water exceedeth the fire.

Ariſtotle in the place before quoted refers the variety of the colours to the plenty or ſcarſity of humours, and maketh demonſtration of his opinion by the example of aire and water: for, ſaith he, if you looke vpon a deepe water, or a thicke aire they will ſeeme black and obſcure. But if there be but a little of either, then will their colour appeare blewiſh & bright, This conceit of *Ariſtotles*, *Columbus* reprehendeth, but *gratis*; for he addeth no reaſon againſt him.

Galen.

Thirdly, *Galen* in *Arte medicinali* is of opinion that the plenty of ſplendor and ſcituation the chryſtaline and watery humors is the cauſe of this variety of colours. The eye ſaith he becom-

becommeth skye-coloured, either becauſe of the plentie or ſplendour of the Chryſtaline humour or by reaſon of his prominent ſcituation, whereto hee addeth the paucity and purity of the watery humour. The eye is blacke when the Chryſtaline is little or ſcituated ſomewhat too deepe, or becauſe it is not exquiſitely bright, or becauſe the watery humour is ſomewhat more plentifull and yet not pure. *Veſalius* reprehendeth *Ariſtotle* and *Galen* in theſe words, which indeed are but bare words. This colour, ſayeth he, ariſeth not from the plenty, defect or tenuity of the humours of the eye, neither yet from the collection or dilatation of the Apple, and finally not from the depth of the eye or the tenuity thereof.

Auicen.

Fourthly *Auicen* referres the cauſe vnto the colour of the grapy coate, which as it is diuerſly depainted ſo it bringeth forth in the eye diuers colours: if it be sky-coloured the eye is alſo sky-coloured, if blacke the eye is blacke. And him doth *Veſalius* follow.

Auerhoes.

Fiftly, *Auerhoes* imagines that the whiteneſſe of the eye proceeded from cold, and the blacknes from heat.

Varolius.

The ſixt opinion is that of *Varolius*, who ſayth that the cauſe of the colour is to bee referred to the vnequall plenty of the ſpirit and of the watery humor, which as it falleth in diuers parts of that place ſo it repreſenteth diuers colours. The colour ſayth he which reſulteth from the grapy membrane receding or giuing backe from the horny, is wont to be called the Rayne bow from a certaine appearing variety: hee calleth it an appearing variety, becauſe in very trueth there is not in that place any true diuerſity of colours but only in apparition, becauſe the horny membrane ſtandeth vnequally aboue the grapy, and ſo an vnequall quantity of ſpirits and humour fall between them.

Archangelus.

The ſeauenth opinion is that of *Archangelus*, who writeth that the diuers colours in the Raine-bow are cauſed by the inequality of the veines which are in the grapy coate (which veines are alſo communicated to the coate called *Aranea* or the cob-web) contayning in them blood diuerſly prepared according to the variety of the partes that are to bee nouriſhed, which are much vnlike other parts of the body. Hee imagineth alſo that the grapye membrane is not of one colour in men, that their eies being wearied might bee recreated, eſpecially by greene, of which there is moſt in the world; and hence it is that we doe often ſhutte our eyes, that ſo the ſpirites that are ſpent or wearied may bee reſtored and refreſhed.

Laurentius which is alſo the truth.

The eight opinion is that of *Laurentius*, who referreth the cauſe to the watery and chryſtaline humours, to the variegation or diuers colours of the grapy coate and to the ſpirits, which opinion alſo we will follow as ſeeming moſt reaſonable. For the cauſe of the sky-coloured eye in reſpect of the chryſtaline humour is the plenty thereof, the ſplendor and the prominent ſcituation; in reſpect of the watery humour the ſplendour and the paucity, for when the watery humour is but little it doth leſſe hinder the fulgent brightnes of the chriſtaline.

The cauſes of the skie-coloured eie.

The cauſes of the black eie.

The blacke eye hath quite contrary cauſes, to wit the paucity of the Criſtalline humor his impurity and deepe ſcituation, as alſo the impurity and plentie of the watery humour.

The colours betwixt theſe depend vpon intermediate cauſes.

In reſpect of the grapy Membrane, the colours of the eye do differ, as when it is ſimply variegated or diuerſly ſtreyked then is the eye alſo of diuers colours, becauſe in that place the Grapy membrane is diuerſly diſcoulered.

In reſpect of the ſpirits the colours of the Rainebow differ, for thinne, pure, bright and plentifull ſpirits make it skie-coloured, on the contrary craſſe, impure, cloudy and few ſpirits may be the cauſe of this blackneſſe.

The vſe of the colours of the Raine-bow.

The vſe of this variety of colour in the Rainebow ſome referre vnto beauty, or happely by reaſon of this diuerſity of colours the diuers colours of externall things are there better expreſſed and offered to the Criſtalline humour. But in thoſe creatures which ſee in the night, the *Iris* is only a bright place which if it happen in a man, as *Suetonius* reporteth of *Tiberius Cæſar*, he alſo wil ſee in the night.

Finally this grapy membrane ſome of the new writers, as *Fucſhius* and *Aquapendens* imitating the Arabians haue deuided into two partes, the forepart they call *vuea*, and the backpart *Choroides*.

From the circumference of the grapy coate [Table 3. fig. 17.] doe directly proceed certaine ſmall filaments or ſtrings like black lines, which reſemble the haires of the eye-lids. Theſe ſtrings reach vnto the margent or brimme of the chryſtaline humour, and although they be placed in the cob-web yet they compaſſe the chryſtaline humour round about. By

the

the mediation of these hairy threds the grapy Membrane is ioyned to the circumference of the Membrane which immediately inuesteth the Cristalline humor [Tab.3.fig.7.OO] and so the cristalline humor it selfe is tyed to the neighbour partes: wherefore because it doth the office not of a Membrane but of a Ligament or Tie; *Fallopius* for the forme calleth it *Ligamentum Ciliare* or the hairy Ligament, others call it *Interstitium Ciliare*, because it disseuereth the watry humour from the glassy.

Fallopius.

CHAP. VIII. *Of the Cobweb or Membrane of the Cristalline humor. Of the Membrane which compasseth the glassy humor, and that coat called* Retina, *or The Net.*

The Cobweb or coat of the cristalline humor.

THE Membrane which immediately compasseth the Cristalline humour is called in Greeke ἀραχνοειδὴς, *Aranei-formis*, that is the Cobweb, most properly is it called *Cristalloides* from the humour whose proper coate it is, yea the verie superficies of the same. Some call it the Looking-glasse, beecause it is bright and transluciđ. Some thinke it hath his originall from the *Pia Mater*, and of that opinion is *Columbus*. Others from the coate called *Retina* or the net as *Aquapendens*, but *Archangelus* conceiueth that it is made of the Opticke Nerue dilated and drawne out into a wonderfull thinnesse. But wee are of opinion saith *Bauhine*, that it is engendred in the first conformation, together with the Cristaline humor which is framed of the purest and brightest portion of the seed. It is a Membrane most thinne (so saith *Hippocrates* in his Booke *de Locis in homine*) very fast, most light, white, bright and shining beyond measure, the better to admit the light and to be changed thereby, (for onely this Membrane dooth indeede receiue and apprehend the affections of the light) and least if it had bene thicke it should haue hindred the sight.

Diuers opinions of his Originall.

The substance of it.

The substance of it is much like the inward skinne of an Onion or rather like a spiders Cobweb, for the fineneſse I meane, and not for the density or fastnesse thereof. This Membrane couereth the cristalline humor both on the foreside and the backside immediately compassing and establishing the same. Although I know that *Galen* in the sixte chapter of his tenth booke *De vsu partium* writeth, that it inuesteth this humour onelie there where it toucheth the grapie Membrane, with whom *Archangelus* also agreeth. But that the whole cristalline humor might be more fit for sensation, it was necessary that it should be compassed round with this Membrane, which notwithstanding we acknowledge to bee thicker, faster and stronger on the fore-side. For because wee see before vs therefore the faculty and power of this sense ought there to bee more vigorous, because in that place the light is more stronglye vnited by the roundnesse of the Cristalline and the refraction of the watery humors. And therefore *Ruffus* calleth it *Visio & Pupilla*, the sight or Apple of the eye. And because in this as it were in a glasse the Effigies or Image of the *Pupilla* doth consist, therfore *Galen* in the place next before quoated, calleth it the Idoll or Image of the sight. On the contrary the backpart of it is looser, thinner and more rare.

Why thicker before.

The vse of it.

If this Membrane be taken away, the figure of the Cristalline humor is destroyed; for whereas before it was smooth, equall and polished; nowe it falleth assunder and becommeth vnequall not being able to stand togither when the bande which conteyned it is remooued. In a word, the cristalliue humor receyueth from this Membrane not onelie his sensatiue power, nor the forme and figure of his substance, but also his efficacy and virtue. Veynes it hath none, but seemeth to be nourished by the Ciliar Ligament.

The coate of the glassy humor.

The coate of the glassy humor is called ὑαλοειδὴς, which *Columbus* & *Archangelus* haue confounded with the cobweb before described. But the trueth is, that their substaunce is different, for this is thinner then the former and encircleth the glassy humor round about least it should either be diffluent or confounded with the watery humour. Other Anatomists haue altogether pretermitted the mention thereof, because they think that both humors are involued by the *Cobweb* Membrane. In the middest of this coate doth the Ciliar or hairy Ligament appeare.

The Net.

The last Membrane or coate of the eye is called *Retina* or *Reti-formis*, [Tab. 3. fig.8] in Greeke ἀμφιβληστροειδὴς, because it resembleth a little round casting Net. This Membrane ariseth from a part of the Braine descending thorough the Opticke Nerue, or if you vvill, from the marrow of the Nerue it selfe as soone as the Nerue attaineth to the eye, and so hangeth at the very roote of the Nerue, from thence it passeth on to the middle of the eie

and

eye, and within the cauity of the grapy membrane vpon which it immediatly lieth, but is not tied thereto. It is inlarged and like a net or caule compaſſeth the glaſſy humour, but without any connexion at all, *Aquapendens* ſaith, it is inſerted into the vtmoſt circle of the Criſtalline humour, and that by the meanes hereof the Criſtalline ſwimmeth in the midſt of the glaſſy humour as a peece of wood ſwimmeth in the water. It is ſoft, reddiſh, of a mucous ſubſtance, not ſolid and craſſe as is the ſubſtance of the braine. The ſubſtance thereof.

Wherefore, neither in ſubſtance nor in colour is it like a Membrane, and therefore *Galen* in the ſecond chapter of his tenth booke *de vſu partium* ſaith, it neither deſerueth the name of a membrane nor of a coate, for if you ſeparate it from both the humours and lay it vpon a heape by it ſelfe, [Tab. 3. fig. 8. l.] it will ſeeme to you to be a part of the brain dilated, and therefore *Galen* calleth it the net like body; *Veſſalius* ſaith it can haue no fitter name then the name of a coate, albeit *Columbus* and *Platerus* are not of his opinion. Veins and Arteries it hath very many and conſpicuous; and indeed more (though they be ſmall) then ſeeme conuenient for the proportion thereof: for all nerues being inueſted with a portion of the *Pia mater* wherein veines and arteries doe run, this alſo receiueth a veine & an arterie diuerſly branched, wherby Nature hath prouided and prepared aliment not onely for the Nerue, but alſo for the humours of the eye. In theſe veſſels therefore is blood contained, not thicke nor feculent but thin and fluide, whereby the glaſsie and Criſtalline humours might bee nouriſhed, which becauſe they are pure bodyes do alſo ſtand in need of pure blood. The veſſels thereof. The prouidence of nature.

It is alſo darke and corpulent not tranſlucent, that it might not bee affected or changed by the light.

The firſt and greateſt vſe of this Net-like coate is, ſaith *Galen* in the ſecond chapter of tenth booke *de vſu partium*, that when the Criſtalline is altered, it might apprehend the *Senſation*; or rather to leade along the faculty of ſenſation to the Criſtalline humour, becauſe as we ſaid euen now, it ariſeth from the ſubſtance of the nerue. The vſes of it

Another vſe of it is, that the viſiue ſpirits might bee diffuſed through the Criſtalline humour and the whole eye; to perceiue the alterations of the Criſtalline and to tranſport the images of viſible things to the braine as to a iudge.

Finally, whereas it intercedeth betweene the Grapy membrane and the glaſsy humor it keepeth the pure ſubſtance of the glaſsy humor from being defiled with the blackeneſſe of the Grapy membrane. And ſo much concerning the membranes or coates of the eye. Now we proceed vnto the humours.

CHAP. IX. *Of the humours of the Eye,*

The humors which are the moſt noble parts of the eye are contained within their coates, and are three; differing each from other in figure and conſiſtence; yet all bright and perſpicuous, diſtinct in their ſeates, filling the cauities of the eye, and helping the action of the ſight. Theſe three humors are called the Watery, the Criſtalline, and the Glaſsy, amongſt which the Criſtalline excelleth in dignity and vſe and therefore is called the ſoule, the center and an inner Spectacle of the eye. The three humors of the eye.

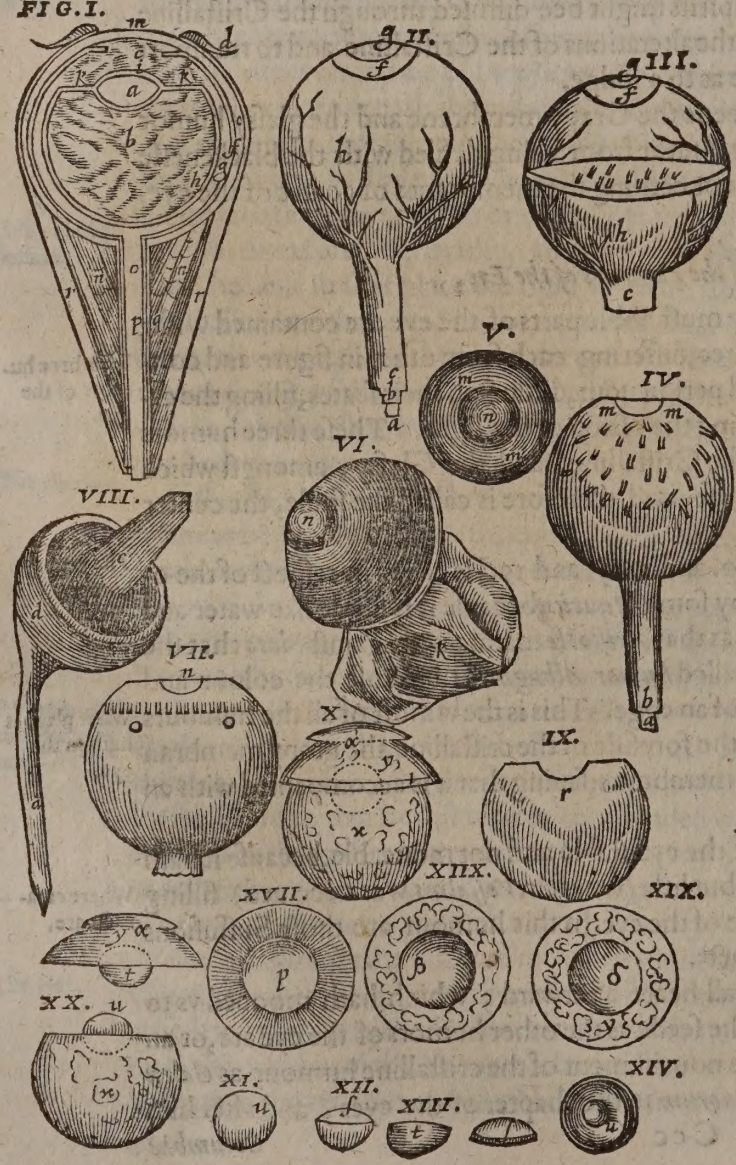
The watery humour [Tab. 3. fig. 10. and 16. y, and 19.] is called in reſpect of the other *humor tenuis* the thin humour, and by ſome *Aqueus*, becauſe it is fluide like water and alſo tranſparent. And hence haply it was that *Ariſtotle* maintained againſt *Plato* that the eye was not fiery but watery. It is alſo called *humor Albugineus*, becauſe the colour and ſubſtance thereof is much like the white of an egge. This is the vtmoſt of all the humours filling the whole ſpace which is betwixt the foreſide of the criſtalline, the grapy membran which is there duplicated, and the horny membrane; ſauing that it is accompanied with an aiery and bright ſpirit. The watery humor. What place it hath in the eye.

It is diſpoſed on each ſide the apple of the eye, ſtable and not moueable, becauſe it hath in it a kinde of *Lentor* or ſlimineſſe. It is but litle (wherein *Veſſalius* was deceiued) filling ſcarſe the tenth part of the circumference of the eye. In this humour are thoſe Suffuſions made which they commonly call Cataracts. Where cataracts are.

The vſe of it is very notable, as we ſhall heare afterward, which hath mooued vs to doubt whether it be a part generated of the ſeede as the other humors of the eye are, or an excrement ſegregated or ſeparated in the nouriſhment of the criſtalline humour as *Galen* hath written in his booke *de Anatomia viuorum* in the chapter of the eyes, and after him

Table 3. *Figure* 1. *ſheweth the Membranes and humors of the eye by lines drawne after the manner of a true eye.*
Figure 2. *Sheweth the horny coate with a portion of the Optick Nerue.*
Figure 3. *ſheweth the ſame diuided by a tranſuerſe ſection.*
Figure 4. *ſheweth the* Vuea *or Grapy coate with a portion of the Opticke Nerue.*
Figure 5. *The Grapie coate of a man.*
Figure 6. *The Horny, Grapie, and the Choroides.*
Figure 7. *The interior ſuperficies of the Grapie coate.*
Figure 8. *The Poſterior part of the horny coate together with the ſaide Net ſeparated from the Eye.*
Fig. 9. *The coat of the vitreous or glaſſy humor cald Hyaloides.*
Figure 10. *Three humors ioyned together.*
Figure 11. *The forward part of the Criſtalline.*
Figure. 12. *The Criſtalline humor couered yet with his Coate.*
Figure 13. *The Criſtalline bared on the ſides.*
Figure 14. *The Criſtalline of a man.*
Figure 15. *His Coate.*
Fig. 16. *The watery, diſpoſed vpon the Criſtaline round about.*
Fig. 17. *The hairy proceſſes beaminglie ſprinkled through the foreſide of the coate of the glaſſy humor.*
Figure 18. *The foreſide of the glaſſy humour.*
Figure 19. *The place of the watery humour.*
Figu. 20. *The glaſſy humour conteining or comprehending the Criſtalline.*

TABVLA. III.



The explication of the firſt Figure by it ſelfe.

a. The Criſtalline humour.
b. The Glaſſy humour.
c. The watery humour.
d. The vtmoſt coate called *Adnata*,
e. the dark part of the horny Tunicle which is not tranſparant.
f, the Grapy coate called *Vuea*.
g, the Net-like coate called *Retiformis*.
h. the coat of the glaſſy humor cald *Hyaloi-*
i, the coate of the Criſtalline. *(des.*
kk, the hairy proceſſes cald *Proceſſus ciliares*
l, the impreſsion of the Grapy coate where it departeth from the thick coate.
m, the horny coate, a part of the thick coate
nn, the fat betwixt the Muſcles,
o, the Optick Nerue,
p, the *Dura Meninx*.
q, the *Pia Mater* or thin Meninx.
rr, The Muſcles,

The explication of the other 19 *figures togither*

a, 2,4,8. The Optick Nerue,
b, 2,4. The thin *Meninx* clothing the nerue
c, 2,3. the thick *meninx* clothing the Nerue.
d 8, the poſterior part of the horny Coate.
e 8, the coate called *Retina* gathered together on an heape.
f, 2,3, the Raynbow of the eye.
g, 2,3, the leſſer circle of the eie or the *pupilla*
h, 2,3. Veſſels diſperſed through the *Dura Meninx*.
i, 3,6. the Grapy coat, but *i* in the 3. Figure ſheweth how the veſſels doe ioyne the hard membrane with the Grapie coate.
k, 6. the horny or hard membran turnd ouer
ll, 3,4. Certaine fibres & ſtrings of veſſels, wherby the grapy coat is tied to the horny.
mm, 4,5. the impreſsion of the Grapie coate where it recedeth or departeth from the horny coate.
nn, 4,5,6,7, the *pupilla* or Apple of the eye.
oo, 7, The Ciliar or hairy proceſſes.
p, 7. The beginning of the grapy coat made of a thin membrane dilated, but *p* in the 17. figure ſheweth the Ciliar proceſſes ſprinckled through the fore-part of the glaſſy humour.
r 9, the boſom or depreſsion of the glaſſye humor receiuing the Criſtaline. *(line*
ſ, 12,15, the bredth of the coat of the criſta-
t, 12. 13, 14, 16, the *poſterior* part of the criſtaline humor which is ſpherical or round.
u, 11, 14, 20, the fore-part of the ſame Criſtalline depreſſed,
x, 10, 20, the amplitude of the glaſſy humor
y, 10, 16. 19, the amplit. of the watry humor
z, 10, the place where the glaſſy humour is diſtinguiſhed from the watry by the interpoſition of the *Hyaloides* or coate of the glaſſy humor.
α, 10, 16, the place where the grapie Coate ſwimmeth in the watrie humour.
β, 18, The Cauity or depreſsion of the glaſſy humor which remaineth in the Criſtalline is exempted or taken from it.
δ, 19. The cauity or depreſsiō of the watry humor made by the ſame meanes.

Columbus, *Varolius* and *Aquapendens*. *Auicen* alſo is of the ſame minde, ſauing that he cals it the excrement of the glaſſy humour. And this doubt is further increaſed, becauſe wee learne out of Anatomy that this watery humour is diſtinguiſhed from the criſtalline by the cobweb-like membrane, and therfore ſhould ſeeme not to bee the excrement thereof but a part by it ſelfe. Whether it be a ſpermaticall part or an excremen.

But becauſe no ſpermaticall part being taken away can be regenerated, whereas wee know that in wounds of the eie this watery humor may be totally loſt & yet regenerated again, we are in doubt vppon what we ſhould reſolue. *Columbus* ſaith, that twiſe he ſaw this watery humor loſt and recouered againe ſo as the patient could ſee with the ſame eye. And *Varolius* affirmeth that he hath ſeene as much. Theſe learned and curious Anatomiſts account it but an excrement, which in many diſeaſes is much waſted as *Platerus* admoniſheth vs. But *Laurentius* will haue it to bee a liuing and ſpermaticall part of the eye, not an excrement, becauſe it perpetually keepeth the ſame figure, purity and quantity. Beſides, it is a defence for the Criſtalline, and like a ſpectacle carrieth the images thereto. If it iſſue out of the eye it can hardly be reſtored, it extinguiſheth the ſight, and finally betwixt it and the Criſtalline nature hath interpoſed a membrane.

The Criſtalline humour [Tab. 3. fig. 11. 13. 14.] lyeth vnder the former; ſo called becauſe it is exceeding bright-like pure Criſtall in ſplendor and tranſparancie, but not in conſiſtence and hardneſſe: and therefore *Hippocrates* in his book *de carnibus* calleth it *Diaphanum oculi*, *Ariſtotle* in the 9. chapter of the firſt booke *de hiſtoria anim.* and in the firſt chapter of the fifth booke *de generatione animalium* called it κόρη the *Pupilla* or Apple of the eye. This humour is a *Similar* part of the body and made of the moſt pure and lucide portion of the ſeede and the ſincereſt or pureſt of the mothers blood. That it is a part may be proued as well by the authority of *Galen* as by reaſon: *Galen* in his ſixt chapter of the firſt of his Method and in the firſt booke *de cauſis Symptom.* reckoneth it among the parts. The criſtalline humour. Whereof made.

Beſide the definition of a part as well generall as ſpeciall agreeth well thereto, for it is generated in the wombe together with the other parts. It hath a proper circumſcription, It liueth. It is nouriſhed and performeth an Act or an office: wherefore *Galen* accounteth both this and the glaſsy humour among the Similar parts. This humour in men is ſcituated right before, [Tab. 3. fig. 1ª.] for the membrane which containeth it cutteth the eye into two vnequall parts, the forepart being foure-fold leſſe then the backepart. Furthermore, it approches nearer to the inward angle of the eie then it doth to the outward.

The reaſon of this poſition is, becauſe it was neceſſary that ſome bodyes ſhould be placed before it, others behinde it; ſome of them to be ſeruiceable vnto it, ſome of them to defend it, and ſome of them to lend it their aſsiſtance: but in Oxen it is nearer to the lower part of the eye.

It is compaſſed by the cobweb-like membrane which, as we ſaid, before is faſt and poliſhed but behind more laxe and rare: when this Membrane is taken of the ſubſtance of, the Criſtalline humour offereth it ſelfe to our ſight, which is wateriſh indeed, but not fluid much like water lightly frozen into a tender yce; and when the membrane wherby it is knit together is remoued, it falleth to the ſides and ſlideth a little downe. This humour on the foreſide is compaſſed with the watery humour, [Tab. 3. fig. 10. & 16.] on the backſide it ſitteth or ſwimmeth rather in the glaſsie humour as a bowle ſwimmeth in the water. [Tab. 3. fig. 10. and 12.

It is deuoyde of all colour, for if it had bene red or yeallow all things that are ſeene would haue appeared red or yellow, as it happeneth with thoſe that are troubled with the Iaundies: wherefore, that it might ſuddainely receiue all kindes of colours which are caſt vpon it, it ſelfe is of noe colour at all but cleare bright and perſpicuous that it might bee altered and changed by the light. For this is the onely cauſe why euery colour hath power to make alteration therein, yea this humour alone is altered by colours and receiueth the images of viſible things. Yet is it not perſpicuous or tranſparant after the ſame manner that the watery humour is perſpicuous and tranſparant, becauſe in it there is made a new refraction of the light: wherefore it is faſter or more denſe that the light in his ſuperficies might bee broken *ad perpendiculum* or with a right line, for ſo the light is better vnited and ſtrengthened. It is moderately hard that the images might be faſtened therein, and thick yet ſo that it is tranſlucide, that the light may paſſe through it. It is ſmooth and notable ſlippery and yet with the ſoftneſſe it hath a *Lentor* or ſlimineſſe, ſo that if you preſſe it it will cleaue like Glue to your fingers. The magnitude of it is much like a The poſition. Why it hath no colour. The magnitude & figure.

lupine or ſmall peaſe. The figure ſomewhat flat like a greater Lentile: whence *Aetius* calleth it *Lenticularis*.

Before it is almoſt plain, yet a little riſing like a Lentile the better to receiue the ſplendor or brightneſſe of the light. Backeward it is ſphericall or round that it might more ſafely reſide in the glaſſy humour. At the ſides it is ſomething protuberated: but becauſe it ſhould not fall out of his ſeat but hang ſuſpended as it weere in the chamber of the eye: it is ioyned to the grapy membrane by the *Ciliar* or hairy ligament, yet that onely in the greateſt circumference of the chryſtaline: but before and behinde it is free, that it might not intercept the continuity of the tranſlucid bodies.

The 3. humor called *vitreus*.

The third and laſt humour of the eie is called *vitreus*, [Table 3. fig. 1.[b] figu. 18. and 20] or the glaſſy humour, becauſe in conſiſtence and thicknes it is like to melted glaſſe, in colour and brightnes to glaſſe when it is cold.

His ſcituatiō.

It is ſcituated in the backepart of the eye eſpecially: ſomewhat alſo before, inſomuch that it filleth the parts of the cauity of the eie if it were diuided into foure [Table 3. figure 10. and 20.[x]] and is foure times as much as is the chryſtaline, the better to containe the ſpirits of the ſight that they ſhould not too ſoone be diſsipated.

Conſiſtence.

The ſubſtaunce of it hath a kinde of conſiſtence, eſtabliſhment or firmitude in it; yet is it farre softer and thinner then is the chryſtaline that it might better giue way thereunto, for the chryſtaline is ſeated therein: notwithſtanding it is not ſo fluide as the watery humour. The ſplendour or brightnes of it is equall to that of the chryſtaline; for ſayth *Aquapendens* they are both of a moſt exquiſite purity, tranſparancy and brightnes.

And figure.

The figure as it is in the eye reſembleth the better part of a bowle cut in ſunder, [tab. 3. figure 9. and 20.] for the backeward ſuſface is round or conuex: the forward is plaine, yet in the middeſt thereof hath it a boſome [Table 3. figu. 9. r and 18. β] whereinto it receiueth the chryſtaline humour. And although it be compaſſed about by the net-like coate called *Amphibleſtroides* whereby it is nouriſhed from the veines diſſeminated there through; yet notwithſtanding it hath a proper coate of his owne called *Vitrea*, which if it be broken this humour preſently melteth and reſolueth into water.

CHAP. X. *Of the vſe of the Humours of the Eye and of the Sight.*

A philoſophicall diſcourſe of the vſe of the eie.

HAuing declared the admirable wiſedome, prouidence and goodnes of God our Creator in the conformation of this diuine member which wee call the Eie: although we haue ſpoken ſomewhat in the Hiſtory of euery particular part concerning their vſe, yet there remaine many things worthy our obſeruation touching the humours, which being ioyned to that that hath bin ſayd before will better abſolue and accompliſh this diſcourſe of the vſe of the eye and the true manner of ſight. Which though I muſt confeſſe that they are more Philoſophicall then Anatomicall, yet becauſe they pertaine to the ſame ſubiect, I preſume the Reader will not abhor from them.

The proper obiects of the ſight, Common.

That the Eyes are the inſtruments of the ſight by which it perceiueth all viſible things as well Proper as Common there is no man ignorant; Proper as all colours, Common as the figure, magnitude, number, motion and ſcite, which are ſenſible qualities common to all the Senſes; ſo that it is truely ſayed that the Eye ſeeth not a *Man* but thoſe thinges which are viſible in *a Man*, as colours together with the ſcite, figure, magnitude, number and motion of his partes, out of which afterward the Soule collecteth that that thing is a Man.

Particular vſes of the parts.

The Eie is framed of many parts, all which were created for the vſe of the ſight. But becauſe in euery organ which is compounded of many parts, there is one ſimilar particle vpon which the action of that organ doth eſpecially depend, it would be knowne what this particle is in the eye: we anſwere that it is the Chryſtaline humour which is the authour of the action, becauſe in it the ſpecies or formes of viſible thinges are receiued and by it iudged of.

Beſide this, there are ſome particles without which the action cannot be; as the optick nerue which leadeth along the faculty vnto the chriſtaline; ſome alſo by whoſe helpe the action is made more perfect, as the membranes and the muſcles: and finally, ſome particles are ordayned for the conſeruation of all theſe, as the Eye-liddes and the partes about them.

Seeing therefore the faculty is deriued from the braine by the opticke nerues vnto the eyes,

eyes, which are set as scout-watches to take knowledge of the ariuall of outward thinges; that they may better apprehend the knowledge of such outward obiectes, it was necessary that whatsoeuer is to be perceiued should touch the nerue: for *Aristotle* sayeth in his third Booke *de Anima*, *That euery action is made by contaction.*

This contaction is here made by a *medium* or meane; for the Sences doe perceiue their obiects through a meane. Wherefore seeing the nerue is separated from the visible obiect, that there may bee scite it is necessary there should bee a contaction either of the nerue to the obiect, or of the obiect to the nerue, or else that either of them should be moued in a certaine proportion to the other. All sense is by contaction.

The two first wayes it cannot be, as euen Sence it selfe leadeth vs, and therefore it must be done the third way. If vision be made the third way, then either something must proceed from the nerue to the visible obiects, or on the contrary something must be sent from the obiects to the nerue, or else both must be: that is, Sight must bee made either by an emission of spirites, or a reception of beames, or else by emission and reception both together, How many waies contaction is made,

Now the spirit is not carried from the nerue to the thing that is to bee seene, for then it would follow that the nerue alone by which the faculty yssueth can absolue and perfect the action of sight, and the iudgement should be made without the eye. Againe, neither is there any corporeall thing transported from the body which is sent vnto our eyes; for then the obiects by continuall diffusion would be diminished. Neither is Vision made the third way, for that a spirite or a beame or a light should yssue out of the Eie vnto the obiect: and againe something of the obiect should be moued vnto the spirite, that so the contaction might be made in the middle, for then the nerue alone would haue sufficed for the action, and the iudgement should haue beene made without the eie. Wherefore we thinke with the Philosopher that this contaction is made by a *medium*, so that a certaine quality with some colour affecting and changing the ayre that is cleare and lucid betwixt the eie and the obiect doeth transferre from the things themselues, the visible *species* by one right line from the obiect to the eyes, yea to the center of the chrystaline humour. So the ayre which is in the middest betwixt the eye and the obiect leadeth along that which is perceiued and first of all the colour; for the ayre is altered by colours which it receiueth by contaction; for euen as the Sun attayning by the brightnes of his light vnto the Element of the ayre illustrateth the same; so coulours when they touch the ayre make a kinde of impression therein, for the ayre is alwayes capable of colours when it is cleare, light and illustrated by the brightnes of the Sunne beames. Vision therefore or sight is made by the reception of visible forms, when the light affected with those formes entreth into the eies through their translucid bodies. First of al with right beames, afterward diuersly refracted or broken and affecteth the chrystaline with some colour, which chrystaline as the primary instrument of sight doth in an instãt receiue those visible formes whereof refraction is made in the membranes a perfection in the coniunction of the Opticke nerues, and finally a perception in the braine. How sight is made.

For the light is the proper obiect of the sight whereby it is moued and affected; Light I say stayned with the formes of colours and externall light, for the eie of a man hath not in it any In-bred light, for then he might see in the darke by sending out a light from his eye. Albeit *Suetonius* reporteth that *Tiberius Cæsar* had such an eye, and that excellent Philosopher and Physitian *Cardan*, as also *Iohn Babtist*, *Porta* of *Naples* do affirme the same thing of themselues. Some creatures there are we know which see worse in the day time then in the night, and therefore they seeke their food in the night season. Whether in mans eie ther be an ingenit light. *Tiberius Cæsar Cardanus. Ioh. Baptist Por.*

Nowe because the light thus affected with the images of visible thinges, must passe through a refraction of his beames, it is necessary there should bee diuers translucide bodies. First the ayre through which it attayneth to the eye, then water in the eye in which this refraction might be made. *Plato* indeed who thought that sight was made *extramittendo*, or by an emission of light out of the eye, thought that the nature of the eie was fiery, yet not such a fire as would burne but onely illustrate; for sayth he there is a threefould fire: one shining and not burning, another shining and burning, and the third burning and not shining. But we are taught by Anatomy & by the whole composition of the eye, that the instrument of sight is watery, and therefore *Hip.* in his book *de locis in homine*, saith that the sight is nourished, that is increased by a moyst brayne. And hereto also may we adde reason, for it is the property of water to receiue; wherefore seeing the formes and images of *Plato* thought the eie was firie. A threefold fire.

outward obiects must be receiued it is necessary that there should be water in the eie.

How the formes are retained.

But because these visible formes should not onely bee receiued, but also retained in the eie, it was necessary that the body of the eie should bee made not onely transluciđ but also dense and fastly compacted: wherefore Nature did not only make the eye watery that there might bee a refraction, but also that this refraction might bee manifould shee hath created transluciđ bodies of diuers consistences; for the watery humour is indeed transluciđ and admitteth the light yet the *Diaphanum* or transparancie thereof differs from the transparancie of the horny membrane that there might bee also a different refraction; this refraction is made from a perpendicular and is in the eie foure-foulde. The first is from the ayre into the horny membrane which is a faster *Diaphanum*. The second from the horny membrane into the watey humour which is a thinner *Diaphanum*; in this watery humour the light is vnited and made stronger, so that it is able to pierce through the third *Diaphanum* which is the christaline humour, wherein as in a faster substance the light is yet more strongly vnited and so passeth on to the last refraction at the glassy humour of which wee shall speake by and by. And as in the eye naturally disposed there are foure refractions, so in the spectacles which make the obiect both larger and brighter there are sixe. For first of all the light entreth into the spectacle which is a thicker *Diaphanum* from the ayre which is a thinner, from the spectacle before it come to the eye it passeth through the ayre again which is a thinner *Diaphanum* into the horny membrane which is a thicker; from the horny membrane into the watery humour which is a thinner *Diaphanum*, from thence into the chrystaline which is a thicker, and finally into the glassy humour so that it proceedeth by course out of a thinner *Diaphanum* into a thicker.

That there are 4. refractions of the light in the eie.

6. in a paire of spectacles.

Another vse of the watery humour.

Another vse of the watery humour is to fill vp the empty space betwixt the christaline and the forward membranes, as also to keepe the horny membrane streatcht or tentered & moyst least if it should grow dry it might be corrugated or wrinkled, and so become thicker and hinder the reception of the visible formes.

A third.

Thirdly, the watery humour sayth *Galen* in the sixt Chapter of his tenth Booke *de vsu partium*, keepeth the horny membrane, the grapy membrane and the chrystaline from exiccation: because the moysture thereof keepeth thē transparant without which there could be no vision at all, for we see that in compunctions or wounds of the eye; when this watery humour is let out and dryed vp, the horny membrane which before was turgide and full falleth into it selfe and becommeth darke and rugous.

A fourth.

The fourth vse of the watery humour is to be a defence vnto the chrystaline, least the horny membrane should touch the chrystaline through the *Pupilla* and offend it with his hardnesse.

A fift.

The fift vse is to restraine the impetuous or violent occursion or confluence of externall colours vnto the chrystaline.

A sixt.

And finally to eleuate or lift vp the formes of visible things as spectales doe, that they might be more fully and directly perceiued by the sence. For when the images of externall thinges are arriued at the narrow hole of the *Pupilla* they are lifted vp and so exhibited in the watery humour, wherein they are made more perspicuous; and this indeede was the chiefe reason why Nature placed so pure and neate a humour before the christaline, which is the prime instrument of the sight.

The vse of the christaline humour.

The vse of the christaline humour is to be the first and chiefe instrument of the Sight, as wherein it is perfected, and therefore some haue called it the Idol or image of the sight, and *Aristotle* calleth it *Pupilla*, haply because we see especially right before vs. That it is the chiefe instrument of sight may thus bee demonstrated. The Philosophers say, *That whatsoeuer is made to receiue any thing must be vtterly free from the Nature of that which it is to receiue, because the same thing can neither worke vpon it selfe, nor suffer from it selfe.* VVherefore that which is the proper Organ or instrument of Sight must haue in it no colour at al, because it is to receiue all colours. And indeed hereby may wee perceiue a thing to bee without colour, when if it bee placed against any colour it representeth the same, as it is in ayre, water, chrystall and such like: wherefore the instrument of sight must either bee ayrie or watery, or chrystaline.

An axiome in philosophy.

Ayrie it might not be, because the colours that are receiued in the ayre do flow through it, making no mutation at all therein; but we know that the instrument doth only then perceiue & apprehend the obiect when it so suffereth therefrom that it is made the very same; seeing therefore that the colours doe passe through the ayre and make no mutation there-

in,

in, it could not be that the instrument of Sight should be airy

In the second place it could not be watery, for though the species and formes of colours make a deeper impression in the Water then they do in the Ayre: yet are not the colours therein so imprinted that a man may behold them in it, but they flow through it also. Nor watery. It remaineth therefore that the instrument of sight must be Cristalline, because that onely can receiue and retaine the visible formes. And this also may bee proued by *Autopsie* or ocular inspection, for if you take a beade of Cristall and set it opposite against a coloured body, which way soeuer you looke you shall see the colours in the cristall, as if the cristal were of the same colour, & did not receiue the impression thereof from those coloured bodyes. Wherefore in the cristalline humor colours are not onely receiued but also so retayned that the power thereof is changed into the colour which it receineth. But cristalline

And the reason hereof is, because there is in the cristalline not onely a watery moysture, but also a glutinous or slymy, which with his lentor and tenacity retaineth the images or formes of the colours.

The chiefe instrument therefore of Sight Nature hath placed within the eye, a round and glutinous humour most like vnto cristall to receiue and retayne the representations of all colours. This cristalline humour if you duely consider when it is taken out of the eye you shall perceiue it hath no colour in it, but will represent any colour layde neere it, as if it were of the same colour.

Moreouer, if you cut this cristalline humour in sunder, you shall finde that it is made of a glutinous and slymy moysture. And because sensation is a kind of reception, therefore was the Cristalline made round.

The action also of the Cristalline humour is assisted by the cobweb-like mẽbrane which compasseth it about, for if you take out the cristalline humour compassed with his Membrane and lay it vpon a written paper, the letters vnder it will appeare much greater then indeed they are, from whence haply came the inuention of Spectacles, and indeed this humour is a very spectacle to the Opticke nerue, gathering the species which fall vpon it and representing them in a larger forme vnto the nerue. The cristalline humour is a spectacle to the nerue.

Sight therefore is perfected and absolued, both by alteration & apprehention or discerning. The alteration is made in the Cristalline by reason of the transparencie therof; yet is this transparancie of another kind then that of the watery humour, that it might bee both altered and also changed by the light. For that the impression might be more firme, it is thicker then the watery humour, that in the superficies thereof the light might bee broken *ad perpendiculum*: for so the light is stronger vnited and corroborated when the beames are obliquely shed abroade and yet meete together againe into one because of their refraction; wherefore the Cristalline humour is thicker then the other translucide bodies that are in the eye, as the horny membrane, the watery and glassy humours; because it was made not onely to returne and giue way to light and colours, but also to deteine them, to suffer from them, and to receiue a sensation of visible things: for the thicknesse thereof prohibiteh the transi ion or vanishing away of the formes which are fixed in the superficies and body therof. For sense is not made without pasion or suffring: now it could not suffer vnlesse the action of the Agent had bene receiued vnto it. Notwithstanding, it is not so thicke or hard that the species or formes could not be imprinted therein, but soft like vnto waxe and viscid that they might cleaue faster thereto. Hence it commeth to passe, that when a strong light, as that of the Sunne, beateth vpon the Cristalline it is pained and offended, because the image of the light maketh a kinde of abode therein. But naturally the image of visible things are no longer retained in the Cristalline then is necessary for their perception, but giue way to others: otherwise the sight wold be imperfect: for before the former images be vanished the succeeding cannot bee admitted, because the alteration remaineth in the Cristalline vntill the representation acquit the place when: that is gone the alteration vanisheth together with it, and so there is way made for a new alteration. How sight is perfected, Why the cristalline is thicke. Why soft.

The conformation also of the Cristalline helpeth much to make the sight perfect, for example. It is smooth and polished, that the formes therein might be most like to the bodyes from which they are diduced. It is round: that the light and the perpendicular beames thereof might in it be better vnited, and againe, that the light might be gathered in his superficies where the sensatiue facultie is the strongest; for so the formes euen of the greatest obiects are conuayed whole vnto the Organ. Notwithstanding on the foreside this The reason of the conformation of the cristalline.

round-

roundneſſe is ſomewhat depreſſed, which depreſsion helpeth much the reception of the formes. On the backeſide it is rounder that the light beeing brought vnto the Criſtalline might be vnited in it ſelfe and not diſparkled, but determine and ſubſiſt in the glaſſy humour.

The reaſon of his conne-xion.

The Criſtalline humour alſo before and behind is at liberty or free from connexion, that the light which entereth alway directly, might haue free paſſage through all the tranſlucide bodyes of the eyes, for by this meanes whatſoeuer is betwixt the Criſtalline humor and the thing ſeene is continuated by a continuity of tranſparancy. Yet ought it not to be on euery ſide looſe, becauſe then any extraordinary motion might haue violated the frame of the eye. Nature therefore hath hidde it in his circuite to the neighbour parts, and ſcituated it in the middeſt, that it might receine the miniſtery of all the reſt.

The vſe of the the glaſſy humour.

The glaſſy humour is ſeated after the Criſtalline, leaſt if the light ſhould haue paſſed on to the Net-like and Grapie Membranes which are coloured, ſhould haue returned againe to the Criſtalline defiled with thoſe colours, and ſo the ſight haue bene forſtalled by thoſe inward colours which are neereſt vnto it. Againe, at this *Diaphanum* of the glaſſy humor, there is a new refraction made of the light, not ſuch a refraction as is in the Criſtalline wherby the light is more vnited, but becauſe the ſubſtance of the glaſſy humor is more rare and thin, the light therein is diſperſed and weakned, ſome ſay alſo vaniſheth, others that it reacheth from thence into the cauity of the Opticke Nerue where the ſight is perfected, and ſurely the ſinnewes of the net-like Membrane is not able to returne the light that beateth againſt it, but rather giueth way thereto.

Galens credit redeemed by a diſtiction.

Another vſe of the Glaſſy humour ſaith *Galen* is to nouriſh the Criſtalline, which it doth *per Diadoſin* or tranſumption, for he thought that the Criſtalline humor could not be nouriſhed by blood. But to ſaue *Galens* credit, we muſt heere diſtinguiſh, for al parts are nouriſhed by blood; now the Criſtalline is a part and therefore it is nouriſhed with blood. We anſwere, that it is not immediately nouriſhed with bloode but mediately, for becauſe there are no Veines neither in the criſtalline not in the glaſſy humors (at leſt that the ſight of man is able to apprehend) blood cannot be conueyed vnto them; neyther indeede ought it leaſt it ſhould haue infected the Criſtalline with a redde colour, which woulde haue bene a great hindrance to the ſight, for it behoued aboue al things that the criſtalline ſhould be free from all colour, becauſe it was to receiue all. Wherefore it was neceſſary that his Aliment ſhould be prepared and not conueyed vnto him before it were fitted for his vſe.

How the criſtalline is nouriſhed.

The blood therefore conteined in the Veines of the Grapy Membrane in which it is thicke and blackiſh is powred foorth into leſſer branches running through the Net-like Membrane, where it receiueth an alteration becomming very thin and of a cleare ruddineſſe, which blood is receiued by the glaſſy humor therein prepared and made a fit Aliment both for it ſelfe and for the criſtalline. Hence it is that *Galen* ſaith, *The Glaſſy humor to the Criſtalline is like the ſtomacke to the Liuer.*

Diuers opinions concerning the nouriſhment of the Criſtalline humour.. *Galens* opinion.

But becauſe Anatomiſtes are of diuers opinions concerning the nouriſhment of the Criſtalline humour, it ſhall not bee amiſſe to giue you a taſte of euery mans apprehenſion in this matter, eſpecially of thoſe that are accounted Maiſters in Anatomy.

Galen therefore in the firſt chapter of his tenth Booke *De vſu partium* ſayth, that the Criſtalline humour is nouriſhed by the glaſſy, and the glaſſy by that bodye which compaſſeth it about, to wit, the Net-like Membrane, and that *per Diadoſin* or a tranſumption of matter, becauſe (ſaith he) the criſtalline humor which is white, cleare and reſplendent ought not to be nouriſhed by blood, as whoſe qualities doe differ much one from the other, whereas the aliment ſhould be familiar to that which is nouriſhed thereby. Nature therefore prepared for it a proportionable aliment, to witte, the glaſſye humour, which glaſſy humor by how much it is thicker and whiter then blood, by ſo much doth the criſtalline humour exceede it in humidity and whiteneſſe, for this criſtalline is exquiſitely white and moderately hard.

Varolius.

Varolius enclineth to *Galens* opinion, his wordes are theſe or at leaſt to this purpoſe. Euery thing is nouriſhed by ſuch a ſubſtaunce which determineth neareſt vnto that which it ſnould nouriſh, and therefore the glaſſy humour is immediately placed behinde the criſtalline, and is of a ſofter and a thinner conſiſtence, alſo becauſe ſo noble a part which needeth ſuch abundance of ſpirits becauſe of their continual expenſe ſhold not at any time be defrauded of nouriſhment, Nature made ſo great a quantitie of the

glaſ-

glassy humour, in which nutrition the Chrystaline turneth into his owne nature the thicker parts of the glassy humour because it is farre thicker and faster then it. But the thinner part of the glassy humour she separateth as an vnprofitable excrement from the Chrystaline, and thereof maketh the watery humour. Thus far *Varolius*.

But sayth *Archangelus* (who thinketh that the Chrystaline is so nourished with the glassie humour as a bone is nourished with the marrow) if the chrystaline and glassy humours be parts of the body then one part shall nourish another? But it may bee answered, that there is a surplussage of the nourishment of the glassye humour which is a conuenient Aliment for the chrystaline. Another question may be asked, sayth he, how *Galen* sayth that in the glassy humour there is no veine? It is answered that there is no veine conspicuous, but yet there are very many which are so slender that the eye cannot discerne them, and hence it is that the glassy humour is not so white as the chrystaline, because it is sprinkled with many blinde veines. In like manner in the white of the eie which is called *Tunica Adnata*, there appeare no veins at al, but if the eye be inflamed then many veines which before lay hid doe rise vp and become conspicuous. If the braine of a man bee dissected, there appeare no veines therin, but if it be inflamed then, sayth *Archangelus*, may an infinite multitude be perceiued to run through his substance. *Archangelus.*

Laurentius conceiueth that the glassy humour is nourished by bloud, and receiueth small veines from the *Ciliar* or hayry crown; and that the glassy humour prepares the bloud for the chrystaline, which bloud it changeth least the purity of the chrystaline should be infected, but he doth not thinke that the substance of the glassy humour is conuerted into the chrystaline and assimilated thereto. *Laurentius.*

Aquapendens his opinion is, that the christaline is nourished by bloud, and that as bones and membranes which are very white and farre remooued from the Nature of bloud by a propriety of their temperament doe change the bloud into their substance: so it commeth to passe in the chrystaline humour; and that the bloud is conuayed out of the veines of the grapy into the net-like coate and there depurated that it might better be conuerted into the nitid and pure substance of these bodies. The thicker part is thrust downe into the grapy coate and there collected. The thinner part maketh the watery humour. Neither doth he thinke it possible the Chrystaline should be nourished by the glassy humour, *per Diadosin* or Transumption, because the cobweb like membrane commeth betweene the two humours, which *Galen* was ignorant of, who thought that the forepart only of the Chrystaline was couered, and from that mistaking fell into that errour of nourishment by Transumption. And so much concerning the nourishment of the humours. *Aquapendens.*

Two other vses there remaine of the glassy humour, the one to retaine the spirites for the illustration of the Chrystaline; the other to defend it from the hardnesse of the membranes, and to make it a seat wherein it might securely rest it selfe. Other vses of the glassy humour,

CHAP. XI. *Of the outward Eares.*

HAuing thus absolued the History of the Eye, it followeth that wee come vnto the organ of Hearing, which *Aristotle* calleth *Sensum disciplinæ*, because it was created for the vnderstanding of Arts and Sciences: for Speach, because it is audible, becommeth the Cause of that we learne therby as the Philosopher saith in the first Chapter of his Book *de Sensu & sensili*. This instrument of the Hearing is the Eare, framed by Nature with no lesse Art then the former. Yea so full of intricate Meandersis it; that it wil be very hard to be disciphered, so many & so smal are the particles therof, and couched so close in narrow distances or nookes betweene the bones. Notwithstanding we will endeuour our selues for your satisfaction to acquaint you what wee haue learned, as well by dissections as out of the writings of learned men, especially *Fallopius*, *Eustachius*, *Volcherus*, *Arantius*, *Aquapendens* and *Placentinus*. But in the pursuite of this so difficult a taske, we stand in neede and doe implore the helpe of Almighty GOD, that hee would set an edge vpon my wit, saith *Bauhine*, to find out the myracles of his Creation, the Diuinity of his wisedome, and the infinite goodnesse wherewith he hath compassed vs on euery side. Moreouer, that he would giue me power perspicuously to propound and lay open to your capacities a thing so diuersly and quayntly folded vp, that the Eie is scarce able to follow the trayne thereof. The history of the eares very difficult to expresse.

These instruments are called in Greek, ὦτα & ἀλα, in Latin *Aures ab hauriendis vocibus*, as sayth *Lactantius*, in English *Eares of hearing*. The names of the eares.

There

There are many parts of the Eares which ſerue as well for the reception of the ſound into them, as alſo for the *intenſion* thereof. Some of them are ſuch, as without which there is no reception of ſounds, others are neceſſary for better reception and hearing. Finally, others were created for the conſeruation of all the reſt. Wee will diuide the Eare according to *Hippocrates in Coacis* into an outward and an inward Eare, and firſt we will entreate of the outward.

The reaſons of the name.

The Eares ſaith *Ariſtotle* are parts of the head by which we heare, and therefore it may be immagined they are called *Aures quaſi audes, ab audiendo* from hearing. Inſtruments they are of Hearing indeede, as *Galen* confeſſeth in the ſecond chapter of his Booke *De Inſtrumento Odoratus*, but not the principal organs, becauſe if the Eares be cut off cloſe by the heade, yet a man will heare notwithſtanding, as if the noſe bee cut off a man ſhall ſmell though imperfectly.

The reaſon is, becauſe the principal inſtrument both of Hearing and of Smelling lies hid within the ſcul. The outward Eares therefore are helping cauſes, and when they are ſound and whol they are of as great vſe for the Hearing, as the noſethrils are for the Smelling.

Theſe outward Eares properly called *Auriculæ* are in men & beaſts conſpicuous, but in Birds and Fiſhes it is not ſo, for Birds haue onely holes whereby the ſound entereth into their Brains, becauſe their skinne being harder they want matter whereof this Eare ſhould be framed; beſide ſuch eares as other creatures are furniſhed with would haue beene a hinderance vnto them in their flight, as wee ſee a contrary winde blowing vpon a ſaile ſtaieth the courſe of a Ship: as for Fiſhes no man that I know hath yet found out the inſtruments of their Hearing. Thoſe holes which are placed before their eyes we doubt whither they ſerue for Hearing or for Smelling.

What creatures want outward eares,

The outward Eares are placed in the ſame paralel or line with the eyes, yet not ſo much for the better reception of ſounds, which ſaith *Cicero* in his ſecond booke *De Natura Deorum*, of their owne nature do aſcend vpward becauſe they haue their conſiſtence in the aire; but rather from the commodity of thoſe ſofte nerues within the ſcull which were to communicate the animall ſpirit diſperſed through the ſubſtaunce of the Braine vnto the principal Organ of Hearing. Otherwiſe if the eares had their ſcituation onely for the apprehenſion of ſounds, they might as well haue bene placed in any parte of the creature as where they are; becauſe the ſounds are equally communicated to the whole aire that compaſſeth vs about. But on the foreſide they might not be placed, becauſe that roome was to be taken vp for the eies and the inſtruments of other ſenſes. For the Eies, becauſe we ſee by a right line; but we may heare as wel on either ſide as directly forward, as *Ariſtotle* ſaith in the tenth chapter of his ſecond booke *de Part. Animalium*; although I am not ignorant that *Galen* in the eight chapter of his tenth booke *De Vſu partium* is not altogether of *Ariſtotles* opinion.

The reaſon of the ſituation of the Eares.

Againe for the Mouth, partly for the commoditie of receiuing meates and drinkes directly from the hand, partly alſo becauſe it was fit we ſhould turne, not our eies onely but our mouth alſo toward them with whom we diſcourſe.

Thirdly for the Noſe, that the ſauours of meates and drinks by which we iudge and diſcerne whither they be good or ill might more directly ſtrike the ſenſe of Smelling. Moreouer, the Eares were not placed in the backepatt of the head becauſe there are no Nerues deriued thereunto; not in the top of the head leaſt the couering of the Heade ſhould hinder the ingreſſe of the ſound. It remaineth therefore that it was moſt conuenient they ſhould be placed in the ſides of the head or the face iuſt againſt the region of the eies, and alſo be in man immooueable. In bruite beaſts their ſcituation is ſomewhat otherwiſe, to wit, at the toppe of the Face, becauſe their heades hang alwayes downeward vnto the earth to ſeeke theyr Foode. In Beaſtes alſo the eares are mooueable.

Apes Eares.

The Eares of Apes haue a middle poſition betwixt thoſe of men and beaſtes, becauſe it is a creature of a middle figure betwixt the erected frame of a man & the prone or bending poſture of a beaſt. And as their poſition ſo likewiſe is their motion, not to bee immooueable as in Men, nor ſo mooueable as in other beaſts but betwixt both.

Their Figure

The figure of the outward eare is round or ſemi-circular [Tab. 4. fig. 1.ᵛ. Tab. 5. fig. 6ᵇ. Ta. 6. fig. 7, 1] becauſe that which is rounde is beſt ſecured from iniuries, as alſo moſt capacious. On the outſide they are conuexe or gibbous. On the inſide excauated like a denne

Table 4. Fig. 1. Sheweth the skin of the head together with the fat, and the glandules vnder the eares and the muscles of the hinder part of the head and the eares.

Fig. 2. Sheweth the muscles of the eares, of the eye-browes, and a few of the iawes.

TABVLA. IIII.

FIG. I.

FIG. II

A A. The skin of the head together with the rootes of the eares.

BB. The muscle of the eare springing from the *pericranium* or skull-kin.

C. The triangular muscle mouing the skin of the nowle of the head.

D D D. Branches of the externall iugular veine.

E. The tip of the eare.

F. The circumference of the eare called *Helix* in Greeke.

G. The glandules of the eares, in which is the disease called *Parotis*.

The second Figure.

A. The semicircular muscle of the ear drawing the outward eare vpward, which was noted with B. in the first figure.

B C D E F G. The muscle as it were diuided into 3. parts called *Tripartitus*.

H. The hinder part of the outward eare, into which the foresaid muskle is fastened.

I I I I. The circumference of the eare called the wing.

K. The lap or tip of the eare.

L. The little gristle on the outside of the hole of the hearing, which in ancient men is bearded, called *Tragus* because it is like a Goates beard.

M M M. The skull as yet couered with the *Pericranium* or skul-kin.

N N N, The circumference of the temporall muscle.

O, The muskle yet couered with the *Pericranium*.

P, The membrane, couering the said muskle drawne aside

Q Q Q. The fleshy part of the temporall muskle.

R R, The iugular or yoke bone.

S S. A sharpe processe of the lower iaw.

V. The muskle *masseter* or grinding muskle, remooued here from the yoke bone whence it hath his originall, that the implantation of the temporall muskle into the processe of the iaw might appeare.

X, The musklesmaking the Cheeks.

Y, Fleshy Fibres going vnto the lips.

Z, A muskles of the lower lip.

a a, The muskle of the eye-brow.

b b, The vpper eye-lid hauing a muskle with transuerse Fibers.

c, The eye brow hauing a circular muskle, wherby the external parts of the eye are exceeding constringed, as *Placentinus* saith.

den or cornered hole. Yet euen on the inside there are certaine swellings answerable to the cauityes, to breake the violent rushing of the aire or wind or whatsoeuer should vnawares be offered against them. For in these breaches of the eare as it were in hollow bodyes, not onely the sound of the ayre that rusheth in is readyly and exactly drawne and fully receiued: but also it is broken and boundeth or rebounded as a ball against the sides of the inequalityes till the refraction get into the circular cauity and so the sound becomes more equall and harmoniacall. It attayneth also better vnto the Tympane or drum of the eare without trouble or molestation, and is imprinted vppon or into the inward ayre more strongly and more distinctly; and beside, by this meanes the sound continueth longer as we may haue experience if we apply any hollow shell to our eares, for by that meanes the ayre is better gathered and more directly offered to the auditory nerue. The *Scythians* that liue in the cold Northernly countryes haue often their eares rotted off with cold, whereby their hearing is much impaired, to amend which default they fasten about the hole some hollow shell; imagine it be of a great Cockle or Scallop wherein the ayre is concluded, gathered and directed vnto the head.

There a son thereof.

How the Scythians make amends for the rotting of their eares.

The truth hereof may be diuersly demonstrated, first because all sounds are most exactly receiued in hollow and hard bodyes, as bels and such like. Againe, those men whose eares are cut away do receiue sounds and articulated voices after an obtuse, dul or confused maner like the fall of water or chirping of a Grashopper, in somuch that the other eare which

is

is not vitiated is notwithstanding impaired, vnlesse that which is wounded be quite stopt vppe.

Adrian the Emperour. Finally, such as are halfe deafe that they may heare the better, do set their hands to their eare with the palmes forward to gather in the sound, as we reade that *Adrian* the Emperor was wont to do. Another vse of this refraction of the aire is, least it should enter into the Eare too cold if it were not broken and beaten against the sides in the passage whereby it receiueth if not heate yet a mitigation of his coldnesse. And finally, if it were not for these breaches many violent sounds would suddenly rush into the eare to the great offence of the Hearing.

The magnitude of the Eares. These Eares are not alwayes of one magnitude, but in some greater in some lesse, but most-what proportionable to the magnitude of the body, and yet it hath beene obserued that where there is greater store of vitall heate there the eares are some-what the larger. Howsoeuer, they are small in man in respect of other creatures, as well for ornament as because the head of a man (saith *Galen* in the twelfth chapter of his eleauenth Booke *De vsu partium*) was to bee couered eyther with a hat or a head-peece or some other couering; wherefore if mens Eares had bene as bigge as beasts it would haue beene very inconuenient, yet they are large enough to couer the passage.

Why they are two. They are made double, not so much that when one is vitiated wee might haue vse of the other (although this bee a great commoditie) as for the necessity and perfection of the Sense.

The diuision of the outward Eare. The whole Eare which *Vesalius* not vnfitly compareth to a fanne wherewith they dresse Corne, may fitly be diuided into an vpper and a lower part. The vpper which is hard & as it were stretched *Aristotle* in the eleuenth chapter of his first Booke *De historia Animalium* leaueth without a name, but *Gaza* his interpreter calleth it *pinna* [Tab.4.fig.1. Tab.5 [bb]] the Finne, as well because of the forme as also in respect of the vse: for the Forme, because that broad Gristle is not vnlike the Fin of a Fish: for the Vse, because as the fish guideth her selfe in the water with her Finnes, so these gristly partes cleauing to the sides of the head do guide the sound that it passe not away before it is communicated to the *Inward Aire*, and for the same cause it is called by some πτερύγωμα, that is, a *wing*; broade it is the better to entertaine or catch the sound which afterwarde descendeth by the inwarde compasse vnto the arched cauity that leadeth vnto the passage into the head.

The wing or fin of the ears

The lower part which is soft and depending [Tab.4.fig.1.[a] Fig.2.[x] Table 5. fig.1.[a]] is called λοβὸς ἀπὸ τῦ λαμβάνειν, because we take hold of that when we wold admonish a man, and thence haply it was that the eare is consecrated to Memory. The Latines cal it *Fibra*. *Tully* in his second Booke *ad Quintum fratrem* cals it *Ansa Auriculæ* the handle of the ear, we call it the Lap of the eare, because it is a softe and flexible bodie, hauing in it neyther bone to stiffen it, nor gristle to harden it, nor Neruc to stretch it, and therefore it may bee perforated without paine or with very little, as we may see in young folkes of both Sexes, who vsually hang Iewels at it. *Laurentius* well obserued, that it is a signe of modestye or shamefastnesse, because vpon such a passion this part will grow redde. But the naturall vse of it is to conduct the excrements downward which yssue out of the eare.

The Lappe of the eare.

The outward circumference of the eare is called ἕλιξ *Capreolus* of the likenesse it hath to the writhen Tendrill of a Vine. [Tab.4.fig:1,[ff]. Table: 5,fig:1 [bb]] The inner compasse, which is as it were opposite to the vtter, is called ἀντέλιξ. *Pollux* calleth it *Scaphæ*, beecause it is somewhat like a Lighter or Barge. [Tab. 5.fig.1.[cc]] The great cauity which is compassed almost round by this inward circumference [Tab.5.fig.1] is called *Concha*, because it is like the shell of a Periwinkle and this is the principall part of the outwarde eare made so large that it might receiue all the sound which runnes within both Circumferences, but the cauity thereof groweth narrower toward the hole of hearing, that the sound being gathered into a narrower scantling might more suddainely and at once be offered vnto the Organ.

The seuerall parties of the outward Eare and their denominations.

But the Cauity which is next vnto the hole of Hearing wherein the eare-wax is, is cald κυψέλλη *Aluearium*, and the bitter waxe it selfe *Aphrodisæus* calles κυψελίδα. That eminence which is opposite to the hollownesse [Tab.4.fig.2.[l]. Tab. 5. Figure 1,[c]] toward the temples which hangeth like a pent-house ouer the hole of the eare is called by *Ruffus* and *Pollux* τράγος *Hyrcus* the *He-goate*, because in this part there grow haires which in some men are so rigid and stiffe that they are like a Goats beard.

The

Tab. 5. *sheweth the eares and the diuers internal parts thereof.*

Figure 1. *sheweth the whole externall eare, with a part of the Temple bone.*

Figure 2. *sheweth the left bone of the Temple diuided in the middest by the instrument of hearing, whereabout on either side there are certaine passages heere particularly described.*

Fig. 3 & 4. *Sheweth the three little Bones.*

Fig. 5. *sheweth a portion of the bone of the temples which is seene nere the hole of Hearing diuided through the middest, whereby the Nerues, Bones & Membrans may appeare as Vesalius conceyueth of them.*

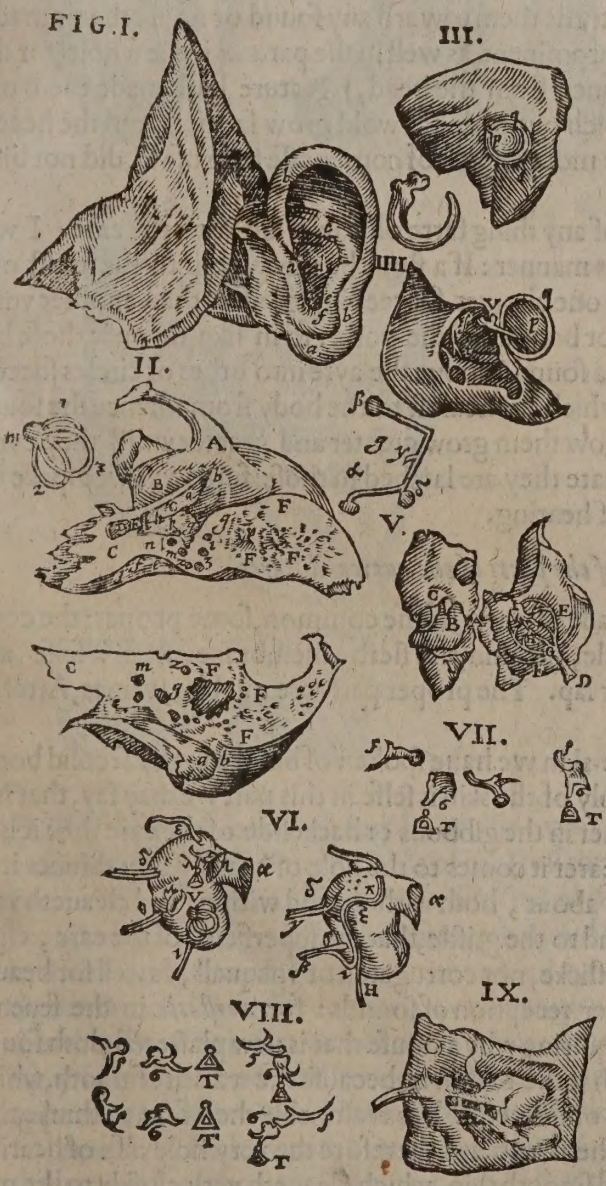
Fig. 6. *sheweth the Vessels, Membranes, Bones & holes of the Organ of Hearing, as Platerus hath described thē.*

Fig. 7, *and* 8. *sheweth the little bones of the hearing of a man and of a Calfe both ioyned and separated.*

Fig. 9. *sheweth the Muscle found out by Aquapendens.*

TABVLA. X.

FIG. I.



a. The lower eare or the lap of the eare.

bb. The circumference of the eare cald in Greeke *Helix.*

cc, the interior protuberation or swelling of the eare called *Anthelix.*

d, The boate of the outward eare.

e, the Goates beard called *Tragus,* wherein are haires growing.

f, The place against the Goats beard called *Antitragus.* *Figure* 2.

A. A part of the yoke bone.

B. The *sinus* or bosome whereinto the lower iaw is articulated.

CC, the stony bone swelling within the Scull.

D. The second hole of the bone of the Temples for the passage of the sleepy Artery.

E, A little seale or thin bone betwixte this hole and the first cauity.

FFF, the porosity or spongines of the stony bone.

aa, The externall hole of the eare.

bb, The bony canale of that passage.

c, the Tympane or Drumme is here placed at the passage.

d, the interiour hole into which the nerue is inserted.

ef. Heere also is the stony bone perforated.

ggg. A canale of the audit ory Nerue from *e* to *g.* in the bone of the Temple *s,* yet this Canale is described by it selfe at the side of the bone aboue the fift Figure.

α, β, Two holes in the beginning and ending of this Canale.

γ, δ. Two other holes in the externall and internall part.

b. The first cauity, according to some the second, reaching from *c* to E.

ii, two canals or pipes of the fyrst cauity.

k, the higher hole which is shut with the stirrop-

l. The lower hole alwayes open. (bone

mm, The second cauity in the bone.

1, 2, 3. Three litle burrows or holes of the second cauity described apart.

n, the third cauity lying vnder this superfycies.

Fig: 3. 4. *o* 3. A long bone representing a pyrami-

p 3, 4. the membrane of the drum. (dal Figure

q 3, 4. A bony ring at the Tympane described also by it selfe. *r,* 4. the Mallet or hammer.

s, The Anuile. *t.* the Stirrop. *Figure* 5.

A, A part of the hole of hearing.

B. A membrane couering the hole ouerthwart.

C. The bone of hearing likened to a hammer.

D, the auditory Nerue. (hearir g.

G, His distribution through the great hole of

E. A branch of this nerue going through a darke hole vnto the Temples.

F. Another branch falling through the hole wher by a veine doth enter in.

H, I. A round cauity in the fore-part whereof is placed, the bone noted with I. *Fig.* 6.

αα The fyrst hole of the Organ of hearing.

β The auditory Nerue diuided into two partes, where it passeth through the fourth hole. *γ* the iugular vein with a part of a nerue pasing through the first cauity. *δ,* where it passeth through his second hole neere to *δ.* *εε* An artery entring that cauitie thorough the third hole, and a nerue falling through the same hole. H, the same artery falling through the fyst hole. *ιι,* the lower part of the 5. nerue reaching vnto the 2 & 3. cauity. *θθ,* A higher part of the 5. nerue broght through the scruing canale or pipe vnto *ε* where it falleth out. *κ,* the Tympane or Drum shutting the first cauity. *λ,* the three little bones of hearing ioyned together. *μ,* the third cauity or the Trumpet of the organ of hearing. V the second cauity or the mettall mine running out with three burroughs. *ξ, ϖ,* The Canale or watercourse carrying a Nerue and an artery, opening it selfe with two holes. *Figu:* 7 & 8, *ϱ* The Hammer *σ,* the Anuile, *τ,* The Stirrop.

The part oppoſite hereto to which the lap grows ſomtimes is alſo haire, [Tab. 5. fig. 1. f.] & called ἀντίτραγος. The vſe of both theſe is to forme the cauity and to hinder the ſweat or any ſuch like excrement or outward thing from falling into the eare. Betwixt theſe two there is a hollowed furrow like halfe a circle, which *Herophilus* calleth ξυσὸς and *Pollux* ἐχινίσχος into which the excrement or whatſoeuer iſſueth out of the eare falleth before it get into the large cauity and ſo fall away by the lap.

The vſe of the outward eare.

The vſe of the whole outward Eare which like a Fan is dilated, was eſpecially to intercept the ſpecies of ſounds wandering through the aire, and to gather them as it were into a boſome, or if you will, into a broade tunnell to be conuayed by manifold breaches or returnes to the hole of the Eare. Againe, the many oblique furrowes in the outward Eare doe breake the violence & force of the ayre, which otherwiſe might haply looſen or break the fine membrane of the Tympane or drumme. There are alſo certaine bunching protuberations where the griſtle ſwels vp into a prominence, which prominence, if the aire doe paſſe the hole of hearing, beats it backe againe forward toward the cauity. For becauſe the holes of the Ears are placed in the ſides of the head the ſound may eaſily ſlip by them, eſpecially when it commeth from behind vs and we moue forward, if it were not caught in theſe conuolutions and in the guttures of the gryſtly ſubſtance conueyed vnto the hole of hearing.

And hence it is that euen by inſtinct of nature we ſee brute beaſts, as Dogs and Horſes will pricke vp their eares, and partly turne them toward any ſound or noyſe that is made. And becauſe the Eare might be thus prominent, as well in the parts as in the whole (for the whole eare ſtandeth of a certaine diſtance from the head,) Nature hath made them of a cartelaginious or griſtly ſubſtance, which out of doubt wold grow farther from the head if Nurſes or carefull mothers who haue more reſpect of comlineſſe then of vſe, did not bind them downe in our infancy.

A ſit ſimilitude expreſſing how the ſounds come through the aire vnto the eare.

If you aske me how the ſound of any thing farre off can ariue vnto the eare; I will anſwer by a pregnant example on this manner: If a ſtone be throwne into the midſt of a pond, it moueth the water in circles, one alwayes ſucceeding greater then another vntill the motion determine in the brinkes or bounds of the pond: ſo in like manner thoſe bodyes which by their colliſion do make a ſound, mooue the ayre into orbes or circles ſucceeding one another, ſo that the circles which are neareſt to the body from whence the ſound came are but ſmall, the reſt which follow them grow greater and greater vntill they come vnto the eare, whereat when they beate they are latched in thoſe furrowes wee ſpake of, and by them directed vnto the hole of hearing.

CHAP. XII. *Of the parts of the outward Eares.*

THis outward Eare is made of parts, ſome common, ſome proper: the common parts are the cuticle, the skin, the fleſhy membrane, fleſh it ſelfe and a little fat in the lobe or lap. The proper parts are muſcles, veines, Arteries Nerues and a griſtle.

The cuticle or skarfe-skin we haue ſpoken of before in the ſecond book, as alſo of all the other cõmon parts; only of the skin it ſelfe in this part we may ſay, that it is exceeding thin, yet ſomewhat thicker in the gibbous or backeſide of the eare then it is in the concauous or foreſide, and the nearer it comes to the hole of hearing, the thinner it is. This skin compaſſeth the eare round about, both without and within, and cleaueth very ſtrongly and firmely to a little fleſh and to the griſtle, that the ſuperficies of the eare, eſpecially the inner might be ſmooth and ſlicke, not corrugated or vnequall, as well for beauty and comelineſſe as alſo for the better reception of ſounds: for *Ariſtotle* in the ſeuenth Probleme of the eleuenth ſection, enquiring why a houſe that is new plaſtered doth ſound better then an old houſe? anſwereth, that the reaſon is, becauſe the wals are ſmooth, which ſmoothneſſe procedeth from denſity or faſtneſſe. It is reaſonable therefore to thinke that the ſmoothneſſe of the eare helpeth the ſound, and therefore the very hole alſo of hearing is inueſted with a thight, hard, thin and ſmooth skin, which cleaueth very cloſely to the mẽbrane there vnder. But where the skin incompaſſeth the lobe or lap of the eare, it is ſo exquiſitely mixed with the membrane and the fleſh that it cannot be ſeparated from them; and therefore we may call that part a fleſhy, fatty and ſpongy skin.

The skin of the outward eare.

Ariſtotle.

Why a new houſe ſounds more then an old.

The veſſels of the eare are theſe. Veines of the eare *Hippocrates* tooke knowledge of, in his firſt booke *de natura hominis*. Branches they are diſperſed on either ſide [Tab. 4. fig. 1.

The veins of the eare.

Table 6. Figure 1. Sheweth the fore-face of the outward Eare without the skin.

Figure 2. sheweth a ligament of the outward Eare whereby it is tyed to the Skull.

Figure 3. The stony processe being broken sheweth the first cauity and the holes thereof.

Figure 4. & 5. shew the Labyrinth, the Snayly shell called Cochlea, *two windowes and three semicircles.*

TABVLA. VI.

FIG. I.

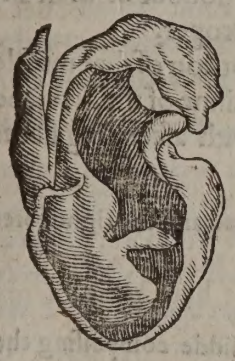


FIG. II.

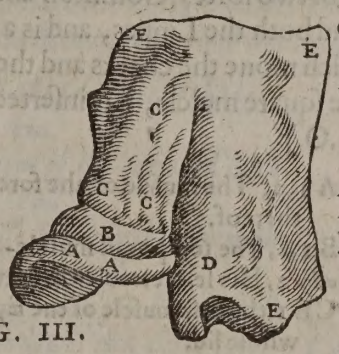


FIG. III.

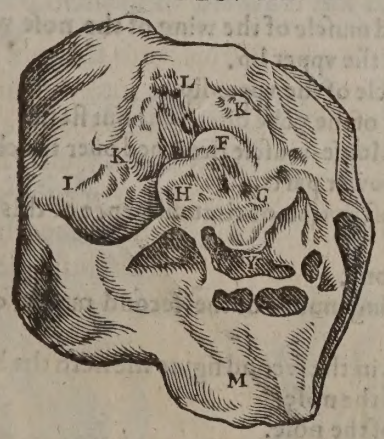


FIG. IV. FIG. V.

Fig. 1. & 2.

AA, The outward eare depressed.
B, The hind part of the outward eare.
CCC, The circumscription of the whole ligamẽt.
D, a part of the yoke bone.
EEE, parts of the scull.

Fig. 3. 4. & 5.

F 3,4,5, the Ouall hole or the window of the labyrinth, in the 4. figure it is broken.
G 3,4, The window of the snayly shell or the winding hole.
H 3, The watercourse or darke hole betwixt the *mammillary* processe and appendix called *Styloides*.
I 3, The *Mammillary* processe.
K 3, The cauity going vnto the *mammillary* processe whose outward face is all spongy.
L 3. The *interior* face.
M 3, The knub of the nowle-bone inarticulated or ioyned to the first rack-bone of the necke.
V 3, The hole of the first payre of nerues of the internall *Iugular* veine. &c.
NNN 4,5, The semicircles.
O 4,5, The inner face of the snayly shell called *Cochlea*.

DDD] from the externall Iugular as also from the lesser braunch of the internall Iugular veine which entreth into the Basis of the scull through the fourth hole of the Temporall-bones. There is a small branch also directed to the Organ of Hearing and into the first cauity [Tab. 2. lib. 7. fig. 13.ⁿ] which bringeth bloud for the nourishment of the parts contayned, and haply also of the ingenite or in-bred ayre. And that there are veines deriued into this cauity, and vnto the membrane or drum, may be proued by the dissection of those bodies that die of an inflamatiõ of the brain or of the eares For if the hole of hearing be featly opned, you shall find small veines conspicuous in the mẽbrane or Tympane, which do not appeare when there is no inflamation, as wee said lately it hapneth in the white of the eye.

The arteries of the eare.

Arteries it hath from the inner branch of the *Carotis* or sleepy Artery which passe to the backeside of the Eare [Tab. 13. Lib. 6.°] that those parts and the in-bred ayre also might be refreshed with vitall bloud and spirits.

The nerues.

Two small nerues it hath from the backeward, and two from the sides of the second coniugation of the marrow of the necke; and these are very small, sayeth *Galen* in the sixth Chapter of his 16. Booke *de vsu partium*, in Men and Apes, becausse their temporall muscles bee very small, and the substance of their eares is immouable: but in other creatures

ſayth he whoſe temporall muſcles and eares are very large, theſe nerues alſo are large, becauſe of the ſtrength required to thoſe motions. The vſe of them in men is to bring Senſe to the eares and ſometimes to moone the muſcles, for thoſe muſcles are not alwayes found.

CHAP. XIII. *Of the Muſcles of the outward Eare.*

MEns Eares are for the moſt part immouable, yet they may be moued, asappeareth as well by their muſcles as alſo by the nerueswhich, as we ſaid euen now, are founde in ſome bodies. But the muſcles are ſo ſmall and the nerues ſo threddy that their motion is hardly perceiued: and Nature made them ſmall becauſe too much motion would haue vitiated the hearing, and therefore the head is rather made to moue ſpeedily on euery ſide toward the ſound or voice, which is not ſo in beaſtes whoſe eares are mouable.

Such as they are *Falopius* firſt found them out; and therefore the honour of their Inuention belongeth to him. They are of two ſortes, Common and Proper.

The firſt is Common to the Eare and both the Lippes, and is a portion of that muſcle which is accounted the firſt of thoſe which moue the cheeks and the skinne of the face, and is called *Quadratus*. [Tabl 7. fig. 1 L] The ſquare muſcle, it is inſerted with aſcending fibres into the roote of the eare [table 6. fig. 1. O.]

Table 7. Fig. 1. Sheweth the muſcles of the Forehead, the Eye-lids, and the Cheekes.
Figure 2. ſheweth the muſcles of the Noſe, Lips, the lower Iaw and of the bone Hyois.

TABVLA. VII.

FIG. I.

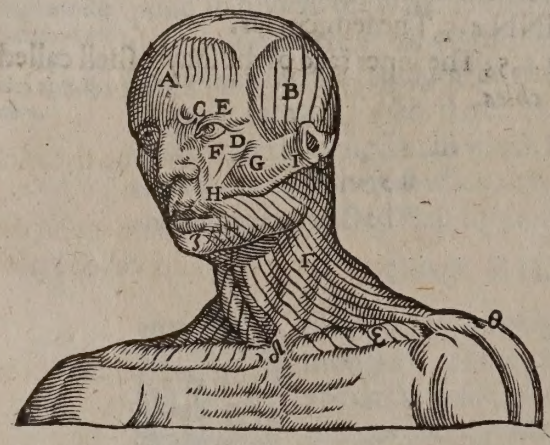
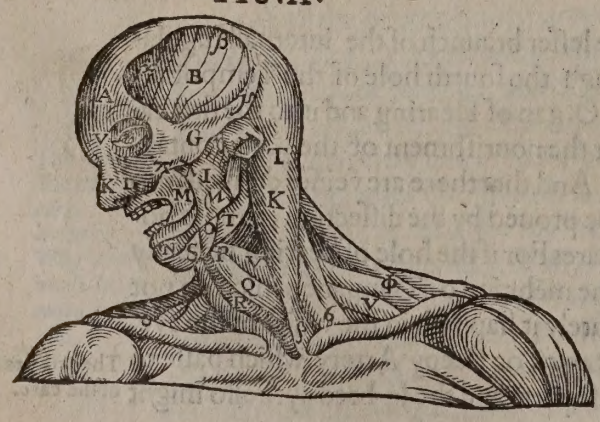


FIG. II.



A 1,2, The muſcle of the forehead and the right fibres thereof.
B 1,2, The temporall muſcle.
αβγ 2, His ſemicircular originall.
CE 1, the firſt muſcle of the Eye-lidde compaſſing the whole lid.
FD 1, the third muſcle of the wing of the noſe which endeth into the vpper lip.
GH 1, the muſcle of the vpper lip.
G 2, The place of the yoke bone without fleſh.
Γ 1, the broad Mouſe-muſcle ſtretched ouer the cheeks and all the lower parts.
δεζθ the circumſcription or circumference of this muſcle.
I 1, the yoke-bone.
I 2, The grinding muſcle or the ſecond muſcle of the Iaw.
The forward K in the ſecond figure ſheweth the higher griſtle of the noſe.
L 2, the wing of the noſe.
M 2, a muſcle forming the cheeks.
N 2, the muſcle of the lower lip.
O 2, A part of the fift muſcle of the lower iaw called *Digaſtricus*, that is, double bellied.
P 2, the bone *hyois* is ſet in this place,
QR 2, The firſt muſcle of the bone *hyois* growing to the Rough artery,
S 2, the ſecond muſcle of the bone *hyois* vnder the chin
The lower T in the ſecond figure ſheweth the third muſcle of the bone *hyois* ſtreatched to the iaw. The vpper T in the ſecond figure ſheweth the inſertion of the ſeuenth muſcle of the head.
VV 2, two venters of the fourth muſcle of the bone *Hyois*,
The backward K (put in ſtead of *X*) ſheweth the ſeauenth muſcle of the head and his inſertion at the vpper T,
χλ 2, The originall of the grinding muſcle from the yoke-bone,
μ 2 the inſertion of this muſcle into the lower iaw,
ν 2 A ſmall nerue running to the forehead out of the orbe of the eyes, π 2, a nerue propagated to the face, ρσ 2, two beginnings of the ſeauenth muſcle of the head. Τ 2, His inſertion into the *Mammillary* proceſſe.
υ 2, The clauicle or the coller-bone. φ 2, A place where the veſſels attayning to the head and the nerues of the arme do paſſe through.

The

The ſecond is a proper muſcle [Table 7. fig. 1. neare [a] Table 4. fig. 1. [a a] figu. 2. [A]] ſeated in the forepart vppon the temporall muſcle, and ariſeth from the vpper end of the muſcle of the forehead, and is inſerted into the vpper part of the eare.

The third [Table 7. fig. 1. neare O] ariſeth from the nowle aboue the *Mammillar* proceſſe, where the muſcles that moue the head and the ſhoulder-blade do end, and is implanted on the backſide of the eare.

The fourth proceedeth from the ſame *Mammillary* proceſſe vnder the ligament of the griſtle of the eare, and is inſerted into the whole roote of the eares griſtle. [Table 4 fig. 2. [H].] One part of it aboue, another part in the middeſt, and the third below. The more exact deſcription of theſe muſcles we referre vnto the booke of muſcles.

CHAP. XIIII. *Of the Griſtle of the Eare.*

THe ſubſtaunce of the outward Eare is neither bony nor fleſhy [the *interior* face of the Eare flayed is exhibited in the firſt Figure of the ſixt Table] but of a middle nature betwixt both, for if it had bene bony it muſt haue bene of a thinne bone or of a thick. If it had bene made of a thin bone, ſaith *Ariſtotle* in the ninth chapter of his ſecond booke

Table 6. Figure 1. Sheweth the fore-face of the outward Eare without the skin.

Figure 2. ſheweth a ligament of the outward Eare whereby it is tyed to the Skull.

Figure 3. The ſtony proceſſe being broken ſheweth the firſt cauity and the holes thereof.

Figure 4. & 5. ſhew the Labyrinth, the Snayly ſhell called Cochlea, *two windowes and three ſemicircles.*

TABVLA. VIII.

FIG. I.

FIG. II.

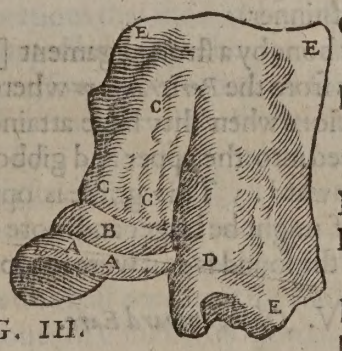


FIG. III.

FIG. IV.

FIG. V.

Fig. 1. & 2.

AA, The outward eare depreſſed.
B, The hind part of the outward eare.
CCC, The circumſcription of the whole ligamẽt.
D, a part of the yoke bone.
EEE, parts of the ſcull.

Fig. 3. 4. & 5.

F 3, 4, 5, the Ouall hole or the window of the labyrinth, in the 4. figure it is broken.
G 3, 4, The window of the ſnayly ſhell or the winding hole.
H 3, The watercourſe or darke hole betwixt the *mammillary* proceſſe and appendix called *Styloides*.
I 3, The *Mammillary* proceſſe.
K 3, The cauity going vnto the *mammillary* proceſſe whoſe outward face is all ſpongy.
L 3. The *interior* face.
M 3, The knub of the nowle-bone inarticulated or ioyned to the firſt rack-bone of the necke.
V 3, The hole of the firſt payre of nerues of the internall *Iugular* veine. &c.
NNN 4, 5, The ſemicircles.
O 4, 5, The inner face of the ſnayly ſhell called *cochlea*.

Why not bony.

de partibus Animalium, then would it easily haue bene broken. If it had beene made of a thicke and solide bone it would haue beene a burthen to the head, and beside would not haue yeelded to outward occurrents. Againe, if it had beene as soft as flesh it would haue fallen into it selfe and haue beene vtterly vnfit to haue made those cauityes, protuberations, furrowes and such like which in the eare are very necessary: neither would it haue receiued the sound which must be returned from a hard body, and so the ingresse of the aire would haue bene hindered.

Why moderately soft.

It was made therefore of a substance moderately soft and moderately hard, that by reason of the softnesse it might be bent on euery side and giue way to the opposition of whatsoeuer doth light against it, that so it might neither be subiect to contusion nor breaking. Againe, the moderate hardnesse thereof makes it fitter to be stretched, to stand vpright, & to be alwayes open, that the ayre together with the sound might euermore gather into it; for saith *Cicero* in his 2. booke *de natura Deorum*, when we are a sleep we haue need of this sense that we might be waked. Moreouer, the hardnesse makes it fit to receiue the cauities and furrowes which are therein, and whereby the sounds are retayned that they passe not the hole of hearing. Yea whilest the sound runneth through those cauityes, *Aristotle* saith, it gathereth strength, and by the refraction is after a sort modulated or tuned and so commeth more welcome to the Tympane.

Cicero.

Why moderatelie hard

Finally, because it is moderately hard it yeeldeth also a sound and so the voyce or noyse is better receiued, and as it were, formed without any eccho or singing, or other noise like the fall of waters which happeneth to those *Scythians* of whom wee made mention euen now, who when their eares are rotted off doe apply hollow shels of Scallops or such like behind the holes of their eares.

The originall of the cartilage.

Wherefore it consisteth of one gristle [Tab. 4. fig 1.] and that flexible, couered ouer with a thin skin which cleaueth close vnto it. This gristle proceedeth as it were out of the temples and standeth a loose from them more or lesse. For the first originall of this grystle is from the orbe [Tab. 3. lib. 7. fig 9. y.] of the hole of hearing which is boared in the temple bone, and exasperated or made rough in the circumference that the gristle might better arise therfrom. At the very original it is thicker & harder; thicker that the root therof might be more firme; & harder because of the neighbourhood of the temple bone from whence it proceedeth; and by how much it standeth further of from the bone of the head by so much it becommeth the softer and the thinner.

The ligament

This gristle is also tyed to the stony bone by a strong ligament [Tab. 8. fig. 2 C C C.] which arisieth with many propagations from the *Pericranium* where it tendeth toward the mammillary processe. These propagations when they haue attained to the eare, doe all ioyne into one ligament, which is inserted into the vpper and gibbous part of the eare, to suspend or hang the gristle streight vpward. This gristle is opposed or set against the hole of hearing that the passage thereof might be larger and more extended into the hollownesse of the gristle, by which meanes the sound is as it were scouped vp.

CHAP. XV. *Of the inward Eare.*

The parts of the inward eare.

THe inward Eare hath many parts, fiue holes or passages, three small dennes, small bones as many; the Membrane or head of the drum called *Tympanum*; two Muskles; a Nerue from the fourth and fifth coniugations: a veine & an Artery and the Inbred Ayre. All which are contayned in one bone called *Os petrosum*, or the stony bone, whose description we will here prosecute at large, because of the bones of hearing therein contained, and make but slender mention thereof in our booke of Bones.

The rockie or stony bone.

This stony bone so called, saith *Vessalius*, because it is like a rugged rocke, [Tab. 3. lib. 7. fig. 9. *f. æ.*] is the third and interior processe of the Temple bone running along obliquely forward from the hole of the eare, betwixt the Mammillary processe and the processe of the yoke bone, and buncheth out in the inner basis of the skull, [Tab. 9. fig. 2. from a. F toward C. and beyond] betwixt the wedge bone aud the nowle bone, so that it is much more conspicuous in the inside of the skull then it is on the outside. This processe is somweat round, the better to containe a greater quantity of *Inbred aire*: long also somewhat like the ridge of a rocke, and that because the nerue of hearing (which is the softest of all nerues except the Opticks) might run his long course from the braine without danger of breaking.

Wherefore

VVherefore the production of this bone is inward to receiue the nerue as soon as it yssueth out of the *Cerebellum* or After-brane. Another reason why this production is lengthned, is because it might make a fit channell or furrow wherein to carry a braunch of the *Iugular* veine or sleepy artery to the braine.

But there where it yssueth out of the Temple-bone it is broader and thicker, that those turnings and cauities which were necessary for the Sense of Hearing might be better insculped or wrought therin; yet as it proceedeth forward it endeth by degrees into a sharp Cone or point where the veine or artery entreth into the brain, and so the whole processe is like a *Pyramis* or spire. [Tab. 9. fig. 3. o.

The names of it.

This bone is exceeding hard for the security of the Organ of Hearing, and harder indeed then any bone of the body, whereupon it is called ὀστέον πετρῶδες *Petrosum* or *Lapidosum*, the Rocky or Stonybone. Some vse to cal the temple-bones *Lapidosa*, & they call this bone *the interior processe of the stony-bone.* In Infants it is called *Os labyrinthi*, the bone of the Labyrinth, in whome it is separated from the temple bones (as also in a Calues head it will easily fall from them when it is sodden) and wanteth the halfe of that passage, which maketh *the hole of Hearing* in growne bodies. For this hole in Infants is altogither gristly and in dissections found distinct from the rocky bone: and therefore because it is without that passage we may in Infants perceiue without breaking the bone, the Timpane as wel the membrane or head of it, as also the bony circle to which the membrane is fastned: but as the body increaseth and the gristly parts grow drie, they turne into bones euen the hole of hearing it selfe; and so the rocky bone groweth very fast to the scaly part of the Temple bone vnder which it lieth, and becommeth as it were a processe thereof.

How it is found in children.

The parts of it.

In describing this bone, we must consider his outside and his inside. His outside as it appeareth either within the scull or without the scull. The outside within the cauity of the scull is couered ouer with a hard & strong crust, as hard as is the substance of the teeth. The superficies thereof is smooth, not rough as it is without the scull but yet vnequall; because in the middle of the length thereof it buncheth out by reason of the *bones of Hearing* which in that place are contained; [Table 9. figure 2. betwixt [n] and the lower [s]] so also in the vpper part there runneth a sharpe and rough line through his length, whereby it is diuided into two sides, and forward it endeth into a rough sharpnesse [Table 9. figure 2. from [s] toward [d].]

The outside.

The perforations of the rocky bone.

It hath many perforations that the ayre hauing receiued as it were the stampe or impression of sounds might passe through them vnto the instrument of Hearing. These perforations are of two sorts, some within the scull some without: within the scull there are two; one is a large and patent hole in the face of the processe which looketh backeward, [Table 4. lib. 7. fig. 10.[a] Tab. 9. fig. 2. from [d] to [l]] and this hole reacheth obliquely outward almost to the very middest of the processe: it is smooth and round in the ingresse, but dilated afterward by degrees as it were into two parts, whereinto the nerue of Hearing is implanted. This hole *Platerus* accounteth to be the sixt of the Temple bones, and the fourth hole of Hearing. But we shall account it for the seauenth hole of the Temples.

Within the scul two.

The first.

This cauity in the bones of Children is shorter, and beareth the forme of a hollowed denne or of a porch. But in grown men when the bone is increased that forme perisheth and it receiueth the figure of a fistulated hole or winding burrough; presently after the ingresse of which burrough (as may be perceiued in the scul without dissection) may be foūd two holes in the bottome of the entrance which goe into two bosomes or pipes, the one vpward the other downward [Tab 9. fig. 2. [ef]] into which the nerue is deuided and through them conuayed. The one hole or pipe is higher and runneth more manifestly toward the vpper part of the hole of Hearing, passing obliquely outward to the inner part of the processe, and so into that canale or pipe which is called *Aquæductus* or the VVater-course. [ta. 8. fig. 3.[n]]

It is distinguished or parted from the second and third cauities onely by a thinne scale, and leadeth along the greater part of the nerue [Table 9. fig. 2.[e]] of which we shall speake in the first cauity.

The other hole or pipe is lower and lesser, sometimes single sometimes double, appearing in the inside of the passage, and leading a long sinal surcles of the nerue into the second and third cauities. [Tab. 9. fig. 2.[f]]

The second,

The other hole of the Stony bone within the scull which *Platerus* calleth the seauenth hole of the Temples and the fift of Hearing, [Table 9. figu. 2. 7] is in the foreside of the processe

Tab. 10. *sheweth the eares and the diuers internal parts thereof.*

Figure 1. *sheweth the whole externall eare, with a part of the Temple bone.*

Figure 2. *sheweth the left bone of the Temple diuided in the middest by the instrument of hearing, whereabout on eieher side there are certaine passages heere particularly described.*

Fig. 3 & 4. *Sheweth the three little Bones.*

Fig. 5. *sheweth a portion of the bone of the temples which is seene nere the hole of Hearing diuided through the middest, whereby the Nerues, Bones & Membrans may appeare as Vesalius conceyueth of them.*

Fig. 6. *sheweth the Vessels, Membranes, Bones & holes of the Organ of Hearing, as Platerus hath described thē.*

Fig. 7, and 8. *sheweth the little bones of the hearing of a man and of a Calfe both ioyned and separated.*

Fig. 9. *sheweth the Muscle found out by Aquapendens.*

TABVLA. X.

a. The lower eare or the lap of the eare.

bb. The circumference of the eare cald in Greeke *Helix.*

cc, the interior protuberation or swelling of the eare called *Anthelix.*

d, The boate of the outward eare.

e, the Goates beard called *Tragus,* wherein are haires growing.

f, The place against the Goats beard called *Antitragus.* *Figure* 2.

A. A part of the yoke bone.

B. The *sinus* or bosome whereinto the lower iaw is articulated.

CC, the stony bone swelling within the Scull.

D. The second hole of the bone of the Temples for the passage of the sleepy Artery.

E, A little scale or thin bone betwixte this hole and the first cauity.

FFF, the porosity or spongines of the stony bone.

aa, The externall hole of the eare.

bb, The bony canale of that passage.

c, the Tympane or Drumme is here placed at the passage.

d, the interiour hole into which the nerue is inserted.

ef. Heere also is the stony bone perforated.

ggg. A canale of the auditory Nerue from *e* to *g.* in the bone of the Temples, yet this Canale is described by it selfe at the side of the bone aboue the fift Figure.

α, β, Two holes in the beginning and ending of this Canale.

γ, δ. Two other holes in the externall and internall part.

h. The first cauity, according to some the second, reaching from *c* to E.

ii, two canals or pipes of the fyrst cauity.

k, the higher hole which is shut with the stirrop-bone

l. The lower hole alwayes open.

mm, The second cauity in the bone.

1, 2, 3. Three litle burrows or holes of the second cauity described apart.

n, the third cauity lying vnder this superfycies.

Fig: 3. 4. *o* 3. A long bone representing a pyramidal Figure

p 3, 4 the membrane of the drum.

q 3, 4. A bony ring at the Tympane described also by it selfe.

r, 4. the Mallet or hammer.

s, The Anuile. *t.* the Stirrop. *Figure* 5.

A, A part of the hole of hearing.

B. A membrane couering the hole ouerthwart.

C. The bone of hearing likened to a hammer.

D, the auditory Nerue.

G, His distribution through the great hole of hearing.

E. A branch of this nerue going through a darke hole vnto the Temples.

F. Another branch falling through the hole wher by a veine doth enter in.

H, I. A round cauity in the fore-part whereof is placed, the bone noted with I. *Fig.* 6.

αα The fyrst hole of the Organ of hearing.

β The auditory Nerue diuided into two partes, where it passeth through the fourth hole. *γ* the iugular vein with a part of a nerue passing through the first cauity. *δ,* where it passeth through his second hole neere to *δ.* *ss* An artery entring that cauitie thorough the third hole, and a nerue falling through the same hole. H, the same artery falling through the fyst hole. *m,* the lower part of the 5. nerue reaching vnto the 2 & 3. cauity. *θθ,* A higher part of the 5. nerue broght through the scruing canale or pipe vnto *ε* where it falleth out. *κ,* the Tympane or Drum shutting the first cauity. *λ,* the three little bones of hearing ioyned together. *μ,* the third cauity or the Trumpet of the organ of hearing. V the second cauity or the mettall mine running out with three burroughs. *ξ, ϖ,* The Canale or watercourse carrying a Nerue and an artery, opening it selfe with two holes. *Figu:* 7 & 8, *ϱ* The Hammer *σ,* the Anuile, *τ,* The Stirrop.

ceſſe, narrow and rough like a ragged cleft through which a ſmall artery paſſeth from the Organe of hearing vnto the ſcull: we will account this hole for the eight of the Temple bones.

The holes of the ſtony bone without the ſcull are three. The firſt (which we account for the firſt hole of the Temples runs into the hole of hearing, [Tab.3. lib.7.fig.9.7.Tab 9. fig.2.a a.] which is called πόρος ἀκουστικὸς *meatus auditorius*. This hole, becauſe of the griſtle which is extended and ſtretched about the beginning thereof, hath a large and ample orifice reſembling a caue or den, and it runneth betwixt the mammillarye proceſſe, & a part of the Iugall or yoke bone. Without the ſcull. The hole of hearing.

In yong children, ſaith *Coiter*, it is all griſtly, in thoſe that are growne it is but halfe griſtly and halfe bony. The griſtly part groweth out of the griſtle of the eare: the bonie out the bony circle of the Temple bone. For in the firſt conformation it is like a bony ring diſtinguiſhed from the Temple bone by a cartilage comming betweene them, from which cartilage ariſeth the membrane of the Tympane or head of the drumme: and this may be perceiued in the skuls of infants new borne till they bee ſixe or ſeuen months old if they be boyled; but afterwards this griſtle is dryed vp & vtterly obliterated & the bony ring or circle, of which we ſhall ſpeake in the next chapter, is no more diſtinguiſhed from the hole of hearing but vnited to the reſt of the bone and ſtreigthned a little, making a long & round bony canal or pipe [Tab.9.fig.2.ll.] wherein to receiue a greater quantity of ayre, & alſo that the paſſage might more patent and open vnto any ſound: which canall runneth inward to the head of the drumme, [Tab.9.fig.2.from e to c.] and that obliquely vpward, or if you will deſcribe the progreſſe thereof from within foorth, then ſay, that it ſlopeth a little downeward, and from behind runneth ſomething obliquely forward into the outward eare, where it becommeth ſomewhat more ample and large.

This paſſage therefore is oblique and winding to breake the vehement appulſion, or ruſhing in of cold ayre, that it ſhould not diſſolue the harmony of the Tympane and nerue of hearing. Againe, that a ſtrong ſound before it affect the Tympane might be comunicated to the *internall ayre* & to the nerue; or be broken and ſo touch the membrane gently & without violence, for a ſlope blow offendeth leſſe then that which commeth in a ſtreight line, and yet for all this we ſee often times that the noyſe of great Ordinance or of Bels, if a man be in the ſteeple, yea an intollerable cold ayer doe affect the Eare with paine and dolour; ſomtimes alſo breake the Tympane from whence deafneſſe followeth. The forme of the hole of hearing.

This paſſage alſo runneth obliquely from behind forward and vpward, leſt thoſe things that fall outwardly vpon the eare ſhould eaſily be admitted into the cauity, as alſo if any thing haue by chance inſinuated it ſelfe that it might with greater facility fall forth againe. It is by degrees ſtreigthned or becommeth narrow; firſt that the ayer being beaten might be gathered into a narrow compaſſe, by which our hearing is farre more diſtinct. Againe, that if any ſmall creatures ſhould get into the entrance of the cauity, yet the ſtreightneſſe thereof in the bottome might ſtay their courſe or returne them backe againe.

The like alſo we may ſay of crummes, of peaſe, or of any ſuch thing that ſhould happen to fall into the eare. There is alſo in this place a bilious viſcide and bitter humor wherwith, ſaith *Cicero* in 2. booke *de natura Deorum*, as with lime ſuch creatures are intangled. Wherefore alſo there are haires growing in thoſe particles of the eare which before we called *Tragus* and *Antitragus* reſembling the beard of a Goate.

This hole alſo is ſolide and hard, for by that meanes the ſound in the paſſage beeing ſtronglyer beaten againſt the bony or hard ſides of the paſſage is ſo much the more intentended then if it had bene more membranous or ſoft. It is alſo inueſted or couered with skin, partly to breake the ſound which would haue bene more vehement if it had beaten againſt a naked bone: partly alſo leſt the bone ſhould haue bene corrupted or tainted by the ayer: wherefore it is hard, thicke, poliſhed and ſtrongly ioyned to the bone. The ſubſtance of it.

Finally, this paſſage in the beginning and the end hath certaine circles, the outward of which is rough, [Tab.9.fig.2.^{b}.] becauſe of the griſtle of the eare which groweth therto: to the inner circle the ſmall membrane of the Tympane or the drumme-head is ſtretched and tyed. [Tab.9.fig.2.^{c}.]

The primary vſe of this hole or paſſage is, that the ayer altered by the ſound, might through it be deriued vnto the eare, and ſo through the concauity thereof might inſinuate it ſelfe from the backepart obliquely forward to the membrane of the Tympane; for through narrow, concauous, ſmooth and hard paſſages ſounds, are commonly carryed, not The firſt vſe of it.

onely

onely with more eaſe, but alſo do more exquiſitely repreſent the nature of the ſound. And this ſhall hee eaſily perceiue that will ſtrike a trunke very gently at one end, ſo that he that ſtandeth by him may not heare it; and yet if a man lay his eare to the back end of the trunk he ſhall eaſily heare how often the fore end is ſtriken; becauſe in the trunke as in a narrow place the ayre is condenſed and by that meanes the ſound vnited and ſharpned: whereas if the ayre that is beaten by the ſounding body ſhall paſſe thorough a large place, it will bee diffuſed and diſsipated and looſe much of his ſtrength.

The ſecond. The ſecondary vſe of this hole of hearing is for the expurgation of the chollericke excrement of the brain, (for phlegme is rarely purged this way becauſe of his thicknes) which through the veines attaineth to the membrane of the Tympane and thorough it ſweateth into the hole of Hearing. In this hole alſo we finde a muſcle of which we ſhall ſpeake afterward.

Another perforation. There is another hole which we account to be the third hole of the Temple-bone [ta. 3. li. 7. fig. 9. V] ſcituated neare the firſt hole of the wedge-bone, and is a great deale narrower then the former. It is oblique, ſhort and double, and admitteth a braunch of the Iugular veine; emitteth alſo or ſendeth out a ſmall branch of the nerue of Hearing.

CHAP. XVI. *Of the Canale out of the Eare into the mouth.*

THe third outward hole of the Stony-bone which we account for the fift hole of the Temple-bone [Table 3. lib. 7. fig. 9. ſ] is ſcituated betwixt the *Mammillary* proceſſe and the appendixe called *Styloides*, and endeth into a hole or canale which paſſeth from the eare into the mouth. Of this paſſage *Ariſtotle* made mention, but *Euſtachius* was the firſt that deſcribed it, and after him *Volcherus Coiter*. This hole or paſſage is like a round pipe or ſmall quill, larger in the beginning and paſſeth obliquely to the inward and foreſide of the Baſis of the braine, and in the middeſt of foure holes it penetrateth the whole bone where it is encreaſed by a ſubſtaunce that is partly griſtly and partly membranous. But before wee proſecute this paſſage further, we will ſhew you thoſe foure holes in the middeſt of which this paſſage thorough the bone is.

Where it perforateth the bone.

The firſt therefore is on the backeſide where the ſleepy artery entreth into the ſcull. The ſecond is on the foreſide through which the fourth coniugation of nerues yſſueth out of the ſcull. The third at the outſide making way for the artery which is to be diſtributed into the *Dura meninx*. The fourth at the inſide is a fiſſure made of the extremities of the wedge and ſtony bones, paſsing obliquely downeward and forward. And in the very middeſt of theſe perforations doth this cauity pierce through the bone.

The ſubſtance of it. Now to return vnto the ſubſtance. VVe ſayd before that it was partly griſtly partly membranous. For at the laſt of the 4 holes or the fiſſure which is common to the wedge and the Tẽplebones the ſubſtance of it is griſtly and very thick. But on the oppoſite part it is not exactly griſtly but as it were membranous & becommeth thinner. This canale thus encreaſed with ſubſtance of another kinde paſſeth between two muſcles of the throate as the forenamed fiſſure paſſeth & neare the root of thoſe proceſſes which we likened to Bats wings, on the inſide, I ſay, of them it determineth into one of the cauities of the noſtrils, & is inſerted into the thicke coate of the Palat neare the roote of the *Vuula*. But the inward extremity or end of this paſſage where it reſpecteth the middle cauity of the noſtrilles becommeth a ſtrong griſtle bunching or ſwelling much outward, which is couered with the mucous or ſlimy coate of the noſe, and ſet as a Porter to keep the end or outlet of the paſſage.

The figure of it. The figure of it is not round but a little depreſſed making 2 angles, the hollownes thereof is much about the proportion of a gooſe quill, yet ſo that it is twice as broad in the ende as it is in the beginning, and is likewiſe couered with a mucous coate, but that thin.

Why griſtly. It was made griſtly that the way might be alwayes open and that it ſhould not hurt the neighbour parts with his hardneſſe, but eaſily yeeld without danger of breaking. Moreouer, it was couered with a mucous or ſlimy coate, which *Laurentius* compareth to a value ſuch as groweth within the veines as we ſhall vnderſtand hereafter: the vſe of which coate is to couer the orifice of this paſſage within the mouth, that euill vapours might not exhale out of the mouth into the eares. The termination of this paſſage is on both ſides common to the noſethrilles, the pallate and the canale it ſelfe, that by this meanes the mouth might be a fit receptacle for all the kindes of excrements of the braine; and (which ſheweth the wonderfull prouidence and wiſedome of Nature or rather of the God therof)

Where it determines in the mouth.

the

the very end of it is where the muſcle of the Chops is ſcituate; that ſo when vpon our ſwallowing the chops are dilated or opened by the muſcle, this paſſage alſo is recluded or opened to giue way to the deſcending excrement.

The chiefe vſe therefore of this paſſage is for expurgation, to leade along the ſuperfluities that fall from the heade, by the eare into the mouth, as alſo to purge and depurate that aire which is implanted in the inſtrument of hearing; for it was neceſſary that many excrements ſhould in this place be gathered together, becauſe the Braine lyeth aboue it which yeeldeth much excrement: and we may well conceiue that many of thoſe Excrements are gathered together about the eare, by the quantity that iſſueth ſometimes outward through the hole of hearing. The chiefe vſe of it.

An honeſt man of good credit tolde me that hee had beene deafe three or foure yeares, at length his eare was cleanſed by one that profeſſed ſome skill in curing deafeneſſe, and that in two daies he drew out of his eare the quantitie of two great Wall-nut ſhels ful of wax, and that therupon he inſtantly recouered his hearing againe. If therfore there were ſo manie thinne excrements which could ſweate through the faſt membrane of the Tympane, what a multitude ſhall wee imagine may lurke within, which for their thickneſſe cannot poſsibly ſweate through? A Storie

Aquapendens alſo teſtifieth, that he hath often obſerued theſe inward cauities eſpecially in children to be full of a thicke humour, ſlimy and mucous, which ought to haue bene purged away by this canale or paſſage: otherwiſe if it ſtay within, either it altogether ſtoppeth vp the eare, or elſe being reſolued by inward heat is conuerted into wind, from whence come thoſe ſinging noiſes and murmurs of the eares and conſequentlie the deprauation or vtter amiſsion and loſſe of hearing.

Hence therefore we may obſerue, that in inward offences of the eares, it is a very reaſonable courſe for the Phyſitian to preſcribe *Maſticatories*, beecauſe the waies are open, either for nature to expell being prouoked, or for the medicine to draw euen craſſe and thicke matter by this way into the mouth. Beſide by this meanes the paſſage ſhalbe kept drie, and the drier it is the more fit to receiue ſounds. And hence it is, that *Hippocrates* in the 17. Aphoriſme of the third Section ſaith, that the North winde becauſe it is drie makes a man heare the better, and on the contrarie, the South-winde which is moyſt duls and offends the eare. The vſe of *Maſticatories* in deafeneſſe.

Another vſe of this Canale is for the behoofe of the *In-bred aire* of the eare: firſt, to purge it and make it clearer, drier and thinner: againe to reſtore it and refreſh it; for it is not to be doubted but that new aire is ſupplied out of the mouth by this paſſage. For conſidering that the *Ingenit ayre* is perpetuallie waſted by the inbred heate, it is agreeable to the wiſedome of Nature that it ſhoulde bee ſupplied by a regeneration of newe aire which muſt be made of externall aire, becauſe the ingenite aire was at the firſt made of externall. Furthermore, that the aire doth paſſe out of the mouth into the ears, we are taught both by *Ariſtotle* in the eleauenth chapter of the firſt booke of his Hiſtorie of Creatures and alſo by experience, becauſe when a man yawneth wide hee cannot heare what is ſpoken, and beſide he perceiueth a noiſe in his eares. In like manner, when a man blowes his noſe or with anie force conteines his breath, hee ſhall euer perceiue that the aire entereth into his eares, and with a certaine perturbation whereby the implanted aire is diſturbed, becauſe it is a drift not without ſome violence or conſtraint; but vvhen the aire inſinuateth it ſelfe of it owne accord for the refection of that which is bredde in the eare, then is the motion gentle ſo that we do not perceiue it. And beſide the length of the paſſage prepareth and fitteth the newe aire for the refection and nouriſhment of the old. We may alſo imagine that by reaſon of this paſſage *Alcmæon* of whome *Ariſtotle* maketh mention in the place aboue quoted, did thinke that Goates drew their breath not onely by their mouths and by their Noſethrils, but alſo by their eares, which we haue no great Reaſon to thinke ſtrange, becauſe we ſee that cunning Tobacconiſtes (a generation of new and addle Artiſts) can driue the ſmoake out of their mouthes thorough their eare. The 2. vſe of the Canale.

A third vſe of this canale is, that if it happen the ſound cannot directly paſſe vnto the Nerue of Hearing by the hole of the eare, that then at leaſt ſome of it might this waie through the mouth be conueyed vnto the organ of Hearing, and ſo thoſe that are deafe by outward accident might receyue the ſound or voice by their mouths. And this wee may verie well diſcerne by the receipt of the ſound of a Muſicall inſtrument. For if a man The third vſe

How a deafe man may bee made to hear.

ſtoppe

ſtoppe both his eares verie cloſe and hold a wand in his mouth, the other end whereof doth touch any inſtrument that is plaide vpon, he that ſo holdeth the wand in his mouth ſhall be able to diſcerne the Muſicke. In like manner if in the night time you be deſirous to know whether any man be comming toward you, ſet a ſtaffe vpon the ground or but a ſword, and hold the end or pommell betwixt your teeth, and you ſhall heare a great way further off then your outward eare will bee able to diſcerne eſpecially if the waie be ſtonie.

The fourth vſe.

A fourth vſe of this canale is, that in a vehement and violent noyſe ſuch as the ſhooting of ordenance, thunder & ſuch like is, the membrane of the Tympane or head of the drum might be ſecured from breaking, for ſurely it would be in great danger to breake if the *Inbred aire* had no paſſage out. For when this Inbred ayre is mooued if it could not retire backeward, it muſt preſſe the membrane outward toward the eare, and the outward ayre we know forceth it inward, by which two contrary inforcements it could not but be endangered, whereas now the inbred ayre hauing an out-let into which it may retyre, it leaueth the membrane ſcope and roome to yeeld to the impulſion of the outward ayre.

How this paſſage is found in a ſcull.

He that would find this paſſage muſt take a dryed skull and put a hogs briſtle into the hole of hearing, and he ſhall perceiue that it will iſſue out again in the palat of the mouth. But in a greene head the holes of this canale are very conſpicuous in the ſame palate. And thus much of the canale which runneth from the eare vnto the mouth, as alſo of the externall part of the ſtony bone within the skull with the proceſſe and holes that belong vnto it.

Of the ſuperficies of this bone without the ſcull.

The other part of the exterior ſuperficies of this ſtony proceſſe or rocky bone without the skul is diuerſly exaſperated and made vnequall with knubs, boſoms or cauities, poſroſities or ſmall holes and lines running in it. So that the ancients did rightly compare it to a craggy rocke. The vſe of which inequalities is that from them the muskles might better ariſe and into them be better inſerted.

The mammillary proceſſes of the ſtony bone.

This bone alſo hath belonging vnto it a proceſſe and an Appendix. The proceſſe is ſomewhat thicke, and becauſe it reſembleth the teats of a womans dug it is called μαστοειδὴς *mammillaris*. [Tab. 3. lib. 7. fig. 8. M. fig. 9. K.] This proceſſe is not found in infants, but ariſeth afterward. The appendix is ſlender, long and ſharpe, and therefore called ςυλοειδὴς. *Coiter* calleth it *Os ſagittale, os clauale, os acuale*; from the reſemblance it hath with an arrow, with a nayle, or with a needle. It is alſo called πλῆκτρον, becauſe it is like a ſpurre. [Tab. 3. lib. 7. fig. 9. i i.] This appendix in infants new borne is griſtly, but afterward becommeth bony when the bones grow and the griſtles are dryed; yet for the moſt part as it is in other appendices there remaineth in it ſome remembrance of a griſtle. But of theſe we ſhall ſpeake more at large in our diſcourſe of the bones of the head. In the meane time thus much ſhal ſuffiſe to haue ſayd concerning the externall ſuperficies of this ſtony proceſſe of the Temple bones or of the rocky bone whether you will, as well within the skull as without.

Of the appendix Styloides.

The inſide of the ſtony bone Three cauities.

On the inſide this ſtony bone is not ſolide, the reaſon was, that it ſhould not bee too heauy, but thrilled and perforated with infinite holes, dens and ſcrued paſſages, [Tab. 18. lib. 7. fig. 2. *a g*, 3. 2. *m n* E *i*.] and in a word, the greateſt part of it is a very ſponge wherin the implanted or inbred ayre is laboured or perfected. But in the middeſt of it there are three notable cauities formed, eſpecially to help our hearing; the ſmal partitions of which cauities, although they be very thin becauſe the bone ſhould be light, yet are they very faſt and ſtrong bones. But becauſe the membrane of the Tympane or head of the drumme is interpoſed betwixt the hole of hearing and the firſt of theſe cauities, we will intreat of the Tympane before we come vnto the cauitie.

CHAP. XVII. *Of the Membrane of the Tympane or head of the Drumme.*

The names of the mébrane of the Tympane.

THe Membrane of the Tympane which *Hippocrates* firſt of al men, in his book *de carnibus*, made mention of vnder the name of μέρματος πρὸς τῇ ἀκοῇ, that is, *of a skin in the hole of hearing*, is called by *Ariſtotle* in the 83. text of his ſecond booke *de anima* μήνιγξ. *Galen* in the ſixth chapter of his eight booke *de vſu partium*, calleth it σκέπασμα, *a lid*, and στέγασμα, *a couering*. Some call it *Tympanum*, becauſe it is ſtretched ouer the firſt cauity as a peece of Vellam ouer the head of a Drumme, or becauſe as a Drumme being beaten with a ſticke maketh a great ſound, ſo this membrane being beaten vppon by the ayre, communicateth this ſound vnto the

nerue

nerue of ſenſe. But it may moſt properly bee called not the Tympane or drumme, but the membrane or head of the drumme, becauſe it is ſtretched vpon the bony circle wee ſhall ſpeake of afterward, and receiuing the impreſsion of the ſound returneth the ſame againe vnto the ſenſe. [Tab. 10. fig 3. and 4. p. Tab. 11. d.] It is ſcituated betwixt the hole of hearing, at whoſe inward end it is ſet, and the firſt cauity of the inſide of the ſtony bone, which cauity we properly call *Tympanum*. It is extended ouer the cauity obliquely forward and vpward, as if a man ſhould couer the ſloping cut of a writing pen with a filme: and the reaſon of this ſcituation is, becauſe it might more directly reſpect the firſt cauity which is ſomewhat higher then the hole of hearing. Againe, that the violence of the ayre, of water or of any ſuch like that might by accident fall into the eare, ſhould not directly or by a right line attaine vnto the membrane to offer it violence.

Situation. The reaſon thereof. The ſecond reaſon.

The figure of it is round [Tab. 10. fig. 6. α α. Tab. 11. d.] curued a little inward in the midſt like that herbe which we call *Pennigraſſe* or *Venus nauell*, the better to receiue the ſound which commeth from without, becauſe that which is concauous or hollow doth more perfectly, and fully receiue the ſound.

The figure of it.

Concerning the ſubſtance and originall of this membrane, there are almoſt as many opinions as there be writers. Some think it ariſeth from the Brain, ſome frō the *dura meninx*, ſome from the *perioſtium*, ſome from the *pericranium*, ſome from the nerues of the fift conjugation, ſome from the *Pia mater*. But if it may bee lawfull for vs to interpoſe our opinion, we perſwade our ſelues, ſaith *Bauhine*, that it ariſeth from the ſeede it ſelfe, as beeing generated in the firſt conformation as we ſayd before the membrane of the Criſtalline humour was generated; and the reaſon that perſwadeth vs thereto, is, becauſe the very ſubſtance of it differs from the ſubſtance of the other membranes in the body. But if this opinion ſhould not pleaſe, we next of all incline to them who produce it from the *perioſtium* becauſe if you diſſect the head of an infant, you ſhall finde this membrane to cleaue to the *perioſtium*, [Tab. 11. k k.] where it couereth the ſcaly bone and the neighbour parts · as alſo that at the hole of hearing the *perioſtium* is dilated, where there breaketh or riſeth out of the ſtony bone a little oblique and round proceſſe much like a quill, when the firſt oblique inciſion is made in it toward the framing of a pen, which proceſſe was ordayned that this membrane might be connected with the ſtony bone.

Diuers opinions concerning his originall.

This proceſſe is called the ring or the bony circle [Tab. 10. fig. 3. *. Tab. 11. e.] out of whoſe circumference the hole of hearing beginneth. This proceſſe hath a double originall [Tab. 11. n.] the lower groweth out of the ſcaly bone and reſembleth a knub or knot, which bending a little obliquely inward is placed before the doore or entrance of the firſt cauity, where on the inſide it hath a round furrow, or is lightly excauated in the middeſt round about the circumference with two bony brims or edges ſwelling out on either ſide, in which furrow the membrane groweth very faſt round about, that it might bee ſecured frō the violent motions either of the external Ayre entring in, or the internal ayre beating outward, as it happeneth in oſcitations or yawnings when wee hold our breath long, or when we blow our Noſes.

The bony ring.

Wherefore it is moſt like that circle in a Drumme to which the Vellam is faſtened. [Tab. 10. fig. 3. & 4. q. Tab. 11. d.] And this bony ring in infants is eaſily ſeparated from the Temple bone, but in growne bodyes it is ſo cloſe ioyned on one ſide to the ſtony bone on the other ſide to the hole of hearing, that a man would not thinke it had beene euer ſeparated from them: neither indeed can it bee ſeparated in growne bodyes without breaking. Yet the furrow remaineth ſtill to be ſeene. And thus the membrane of the Tympane ſeemeth to be ſeparated in the circumference from the *Pericranium*. But let vs heare what *Galen* can ſay of this membrane.

Galen inquiring into the ſubſtance of this membrane, and inſtituting a compariſon betwixt the couering or coate of the Opticke and the firſt nerue of hearing, and afterward of the inſtrument of ſmelling, ſheweth; *That it was not fit theſe Nerues ſhould be left naked, becauſe then they would haue bene expoſed to all outward iniuries. Seeing then they needed a couering, either it muſt be craſſe and thight as that of the eye; or rare & porous, or in a meane betwixt both. It behooued not it ſhould bee craſſe and thight, becauſe ſuch a couering would haue hindered the acceſſe of the Ayre when it was mooued, eſpecially if the motion were but eaſie, as it is when we ſpeake ordinarily one to another. Neither ought it to haue beene rare and porous, for then the Ayre would haue peirced through it and ſo the nerues ſhould eaſily haue bene offended and the Braine it ſelfe refrigerated.*

A paſſage out of *Galen* prooouing that hee knew this membrane.

Tab. 10. *ſheweth the eares and the diuers internal parts thereof.*

Figure 1. *ſheweth the whole externall eare, with a part of the Temple bone.*

Figure 2. *ſheweth the left bone of the Temple diuided in the middeſt by the inſtrument of hearing, whereabout on either ſide there are certaine paſſages heere particularly deſcribed.*

Fig. 3 & 4. *Sheweth the three little Bones.*

Fig. 5. *ſheweth a portion of the bone of the temples which is ſeene nere the hole of Hearing diuided through the middeſt, whereby the Nerues, Bones & Membrans may appeare as Veſalius conceyueth of them.*

Fig. 6. *ſheweth the Veſſels, Membranes, Bones & holes of the Organ of Hearing, as Platerus hath deſcribed thē.*

Fig. 7, and 8. *ſheweth the little bones of the hearing of a man and of a Calfe both ioyned and ſeparated.*

Fig. 9. *ſheweth the Muſcle found out by Aquapendent.*

TABVLA. X.

a. The lower eare or the lap of the eare.

bb. The circumference of the eare cald in Greeke *Helix.*

cc, the interior protuberation or ſwelling of the eare called *Anthelix.*

d, The boate of the outward eare.

e, the Goates beard called *Tragus,* wherein are haires growing.

f, The place againſt the Goats beard called *Antitragus.* *Figure* 2.

A. A part of the yoke bone.

B. The *ſinus* or boſome whereinto the lower iaw is articulated.

CC, the ſtony bone ſwelling within the Scull.

D. The ſecond hole of the bone of the Temples for the paſſage of the ſleepy Artery.

E, A little ſcale or thin bone betwixt this hole and the firſt cauity.

FFF, the poroſity or ſpongines of the ſtony bone.

aa, The externall hole of the eare.

bb, The bony canale of that paſſage.

c, the Tympane or Drumme is here placed at the paſſage.

d, the interiour hole into which the nerue is inſerted.

ef. Heere alſo is the ſtony bone perforated.

ggg. A canale of the auditory Nerue from *é* to *g.* in the bone of the Temples, yet this Canale is deſcribed by it ſelfe at the ſide of the bone aboue the fift Figure.

α,β, Two holes in the beginning and ending of this Canale.

γ,δ. Two other holes in the externall and internall part.

h. The firſt cauity, according to ſome the ſecond, reaching from *c* to E.

ii, two canals or pipes of the firſt cauity.

k, the higher hole which is ſhut with the ſtirrop-

l. The lower hole alwayes open. (bone

mm, The ſecond cauity in the bone.

1,2,3. Three litle burrows or holes of the ſecond cauity deſcribed apart.

n, the third cauity lying vnder this ſuperficies.

Fig: 3. 4. *o* 3. A long bone repreſenting a pyramidal Figure

p 3,4. the membrane of the drum.

q 3,4. A bony ring at the Tympane deſcribed alſo by it ſelfe. *r,* 4. the Mallet or hammer.

ſ, The Anuile. *t.* the Stirrop. *Figure* 5.

A, A part of the hole of hearing.

B. A membrane couering the hole ouerthwart.

C. The bone of hearing likened to a hammer.

D, the auditory Nerue.

G, His diſtribution through the great hole of (hearing.

E, A branch of this nerue going through a darke hole vnto the Temples.

F. Another branch falling through the hole wher by a veine doth enter in.

H, I. A round cauity in the fore-part whereof is placed, the bone noted with I. *Fig.* 6.

αα The fyrſt hole of the Organ of hearing.

β The auditory Nerue diuided into two partes, where it paſſeth through the fourth hole. *γ* the iugular vein with a part of a nerue paſsing through the firſt cauity. *δ,* where it paſſeth through his ſecond hole neere to *δ.* *εε* An artery entring that cauitie thorough the third hole, and a nerue falling through the ſame hole. H, the ſame artery falling through the fift hole. *n,* the lower part of the 5. nerue reaching vnto the 2 & 3. cauity. *θθ,* A higher part of the 5. nerue breaght through the ſcruing canale or pipe vnto *ε* where it falleth out. *κ,* the Tympane or Drum ſhutting the firſt cauity. *λ,* the three little bones of hearing ioyned together. *μ,* the third cauity or the Trumpet of the organ of hearing. V the ſecond cauity or the mettall mine running out with three burroughs. *ξ, π,* The Canale or watercourſe carrying a Nerue and an artery, opening it ſelfe with two holes. *Figu:* 7 & 8, *ρ* The Hammer *σ,* the Anuile, *τ,* The Stirrop.

Wherefore Nature framed a Muniment or defence, to helpe the security of the Instrument, of a moderate Consistence. And thus hee concludeth: *Nature therefore foreseeing that if shee had made the construction of that Nerue with a strong Muniment, it would indeede haue beene fitte to beare off offences: but the Instrument of the Sense must of necessity haue beene Deafe. Againe, if the construction of the Nerue had had no defence, it would haue beene very subiect to outward iniuries: and therefore shee tooke a way betwixt them both, and made for the construction of this Nerue a helpe, neither too stiffe to hinder the Sense of Hearing: nor too rare, that the ayre should penetrate through it, but of a moderate Consistence, which might not onely secure the Instrument from violence, but also receiue and returne the impressions of sounds.*

Againe, the same *Galen* writing of the couering *of the Instrument of Smelling*, sayeth, *that it needed* σκεπασμα *a Defence more rare then that of the Instrument of Hearing which is fast and thight, because the obiect of the Sense of Smelling is thicker then the obiect of the Sense of Hearing: for the obiect of Smelling is a vaporous substance wherein the odour doeth exhale, but the obiect of Hearing is ayre altered only by an impression of Sounds.*

By this wee may see that *Galen* was not vtterly ignorant of this membrane, and wee haue the rather inserted this passage out of him, because many late Anatomistes haue auouched that *Galen* made no mention thereof at all, but was vtterly ignorant of it. VVe returne now vnto the membrane.

The substance therefore of this membrane is thinne, fast, dry, translucide and of exquisite sence: so thinne and fine that *Hipocrates* compares it tó a Spiders webbe, the better to transmit an easie voice or soft sound (for it was necessary vnto the act of Hearing, or if you wil vnto the pasion of Hearing, that the sound should be communicated with the In bred Ayre although the substances of the outward and inward ayres are not mingled) and yet so strong withall that it might be able to beare a pulsation which might affect the instrument of Hearing. The substãce of the membrane.

VVherefore Bony it behoued not to be, for then the instrument of Sense would haue beene deafe, because the in bred Ayre would not haue receiued the Sound and alteration of the externall ayre, and if the bone had beene so thin that it could haue transmitted the affection of the ayre, then also would it haue bin in danger of breaking. Why not bonie.

It was not fit this couering or instrument should be fleshy, because if that which receiued the sound had beene laxe or loose it would not so well haue transmitted the impression, for wee see that the strayter a drumme is braced the shriller sound it yeelds. Againe, if it had beene fleshy it would haue bin soft and full of moysture, and by that meanes would haue admitted of many things to cleaue or sticke vnto it which now doe fall away from it, because it is membranous. Why not fleshie.

This partition therefore or muniment, or couering, call it what you will, is membranous and thinne withall: for if in the first conformation it bee produced a thicke and fast membrane then is the party deafe incurably, as *Arantius* and *Laurentius* haue well remembred.

But wee finde sometimes before this membrane on the outside that there groweth a certaine thicke coate beside the intent of Nature, of which *Aegineta* maketh mention in the 23. Chapter of his 2. booke, and *Aquapendens* saith he found it twice, but *Aegineta* teacheth also the way how to cure it; yet it is much to be doubted that if it grow from the Natiuity such children will become deafe and dumbe; Deafe because this coate hindreth the appulsion of the sound vnto the membrane; Dumbe because they are not able either to conceiue with their minds or to vtter with their voices, that they are altogither ignorãt of. How children become deafe and dumbe.

And as such a coate or filme before the membrane doth cause deafnesse, so it sometime hapneth that immediatly behinde the membrane there is a collection of mucous matter, or an affluence of some humour from whence proceedeth a great difficulty of Hearing hard to be cured: but if the humour be thinne then the Hearing is not so much impeached as the patient is vexed with ringings, singings, whistlings and hissing murmures in his Eares. Furthermore this membrane is thight and fast, hauing in it no conspicuous pores but neruous & strong, the better to resist outward iniuries & violent incusions of the ayre.

It is also very dry that it might more readily receiue the Sound, and more distinctly make represetation of the same. For we imagine that the image of the Sound is receiued in this membrane without the matter, euen as the images of colours are receiued in the horny membrane of the eye. Beside *Hippocrates* sayth that dryenesse is a great helpe to the conception or reception of Sounds, because that which soundeth shrilleſt is fartheſt hard, Why the mẽbrane is dry.

as we haue experience in ſmall bells which are made of thin and faſt Lattin plate.

This membrane is alſo tranſlucide and polliſhed like a Looking-glaſſe both within & without, ſauing that on the inſide the proceſſe of the bone cald the Mallet or Hãmer is extended vpward vnto the middeſt thereof, like as we ſee in the tayle of a drumme there is a chord ſtretched ouerthwart through the midſt.

The diuers vſes of the membrane.

The vſe of this membrane is to cloſe vp the hole of Hearing in a round compaſſe, & like a hedge or wall to diſtinguiſh it from the fourth cauity of the Stony-bone, and therefore *Laurentius* calleth it *ſeptum*, the partition. It ſerueth alſo to diſtinguiſh the externall from the internall parts of the eare; but eſpecially to ſeparate the In-bred ayre, whoſe duty it is to receiue the impreſsions of Sounds from the externall or the ayre that cometh from without, for if theſe two ayres had beene mixed and confounded, the outward ayre being oftentimes foggy and thicke, muſt needes haue made the inward ayre alſo more vnfit for ſenſation. Neither doeth it only keep the inward ayre from permixtion with the outward but alſo containeth it that it ſhould not vaniſh of it owne accord, or be diſperſed and diſsipated in vehement noyſes or ſounds. Adde hereto that it keepeth out the externall aire ſo that neither the cold nor heate thereof can offend the nerues of the braine. Finally it defendeth the inward parts from outward wrongs, ſo that if a man be ouer head and eares in the water, yet the water cannot paſſe beyond the Membrane: In like maner it keepeth out flies and other ſuch buſie creatures, duſt and whatſoeuer elſe ſhould happen to fall into the hole of hearing.

But becauſe the thinneſſe of this membrane made it ſubiect to bee violated or indangered by ſuch outward accidents, Nature for more ſecurity hath placed on the inſide thereof three bones, a chord or ſtring and two muſcles wherby this membrane is made better able to endure the force of the ayre when it is beaten againſt it.

CHAP. XVIII. *Of the ſmall bones of the Organe of hearing, and of the Chord.*

The finders out of theſe bones.

THe three bones of the Organe of hearing were not knowne to Anatomiſts till the age wherein we liue. Thoſe two which are knowne by the names of the Anuill or the Stithy, and the Mallet or Hammer were inuented or found out by that reſtorer of Anatomie, *Iohannes Carpus* of *Bononia*, and the third *Iohannes Phillippus Ingraſsias* challengeth vnto himſelfe, ſo doth alſo *Columbus* and *Euſtachius*, and well it may be that all theſe being ſo oculate Anatomiſts did find it out by their induſtry. But now we haue them, it ſhall bee more expedient preciſely to deſcribe them vnto you then to determine who were the firſt inuenters of them.

The ſituatiõ

Theſe bones therefore are ſituated in the firſt cauity of the ſtony bone, which before we called the Tympane that is the drume or Taber, and becauſe their figure is diuers they haue alſo diuers names giuen them, partly from the ſimilitude they haue with the things, whoſe names they beare, partly alſo from their vſe. The firſt is called *Malleus* or *Malleolus* the Mallet or the Hammer. The ſecond *Incus* the Anuill or the Stithy. The third *Stapes* the Stirrop [Tab. 10. fig. 6. 7. 8.]

Their nerues.

The Mallet.

The Hammer or Mallet [Tab. 10 fig. 4. r. fig. 5. C. fig. 8. q. Tab. 11. c. l.] is ſeated in the beginning of the firſt cauitie of the ſtony bone [Tab. 10. fig. 2. neere to c.] at the end of the hole of hearing. This bone ſaith *Coiter* hath his name rather from his vſe then from his forme, becauſe when the membrane is mooued, the Mallet alſo is mooued therewithall: or becauſe like a hammer it lies vpon the Anuill, and in the motion beates vpon the membrane. Others doe liken it to the thigh-bone, as *Veſſalius* on this manner. As the thigh neere the necke thereof hath two proceſſes, ſo this ſmall bone hath two proportionable proceſſes in the necke thereof, whereby it groweth more ſtrongly to his membrane. Againe as the necke of the thigh bending obliquely to the cauity of the hanch endeth in a round head; ſo this bone departing inward from the membrane and ending in a round ſmooth & plain head, is ioyned to the vpper part of the other bone by the interpoſition of the membrane, as if a hammer were looſely tyed to a Smiths Anuill. This firſt bone therefore is long and crooked, hauing a head, a necke, and a taile.

His head.

The head is the vpper and thicker part, long and bunching out, for this head is not perfectly round, as hauing ingrauen in the outſide of the top a ſmal and long cauity wherin it receiueth the head of the ſecond bone which we called the Anuill, whereto being ioyned, it lifteth it vpward and forward to the ſide of the hole of hearing.

Necke.

The necke of it is but narrow, yet on the backeſide thereof do two ſmall proceſſes

ſhoote

shoote out, which are very slender and sharpe. To the vppermost adhereth the ligament or chord & the lowermost resteth vpon the membrane that it might not be driuen too far inward or broken. But the vse of this processe I cannot better demonstrate then by those Chords which they vse to stretch vpon the bottome of a drumme whereby it is secured from the violence of the aire which is within it; which aire otherwise being so violentlie and so often beaten, would rend the bottome asunder. Betwixt these is a small cauity & right opposite against it a little knubbe into which one of the Tendons of the Muscle is implanted, as the other is into the necke.

The taile of this bone which *Fallopius* calleth *Pediculus* as it were the *Stalke* is somwhat broad in the top, but endeth into a small knot which receyueth the insertion or tendon of the the Muscle; (*Columbus* addeth, that into this sharpe processe there determineth a a small Nerue from the fift coniugation which affoordeth a hairy and crooked braunch which is inserted into the labyrinth of the eare) presently after it runneth backward and downward, and by degrees endeth into a slender and sharpe processe, somwhat rough and a little incurued or hooked, so that it cleaueth to the Membrane of the Tympane, not in the end or point of this processe but thoroughout his length, yet not in the verie middest of the Membranes bredth. [Tab. 10. fig. 4. from [r] to [z]] And Taile.

The reason of this Connexion is partly to defend the Membrane from outward violence, that it should not be driuen beyonde his extent (wherein also it is assisted by the Chord of which we shall heare euen now) partly to draw it downward and inwarde for the processe we spake of is curued or hooked inward, and by this meanes the Membrane is made inward conuexe, and outward hollowe, in which figure it is also by this processe preserued, whence it commeth to passe that the outward aire which entereth into hole of Hearing slideth from the sides of the Membrane and gathereth it selfe togither in the center where the Mallet hangeth, and beeing so vnited and intended is a great furtherance for the communication of the sound to the inward partes.

Againe, as this hammer groweth to the Membrane [Tab. 10. fig. 6, [n]] by his lower processe and the inferiour part of his taile, as also to the orbe of the hole of Hearing by the benefite of a Ligament which runneth ouerthwart from the prominence which is on one side the hole to the prominence on the other; so that it is no where at libertie, but on euery side fastned to the Membrane: in like maner the head therof is articulated to the Anuill vpon which it lyeth by that kinde of articulation or iuncture which we cal *Ginglymos*. [Tab. 10. fig. 6, 7, 8] For in the Hammer and the Anuile there is a cauity and a head, and the Hammer is moued aboue the Anuile. Notwithstanding this Hammer & the Anuile after a man is dead are so closely ioyned (whither it be so in liuing bodies it is much doubted) that Nature seemeth to haue as much vse of their continuity & vnity as of their diuision and plurality: for being two they do better safegard and defend the Membrane, but their continuation auayleth no whit lesse for the better conueyance of the sound. Wherefore although the articulation of these two bones is worthily saide to be *per Ginglymon* because they mutually receiue and are receiued one of another, yet because of their straite and close copulation some are of opinion that their iuncture is rather to bee referred to that kinde which wee call *Synarthrosis*, the meaning of which words of Art shall be at full expounded in our last booke of the bones. The Cõnexion of the Hãmer.

Finally, the Hammer is a longer bone then the Anuile but withall more slender, because it was to mooue aboue the Anuile, and wee know it is reasonable that that which beareth should be greater then that which is borne. Notwithstanding both these bones in the place where they are articulated or ioyned, are much greater and thicker then in their other part, which thing to say true may bee obserued almost in the articulations of all other bones of the body. The forme of it.

The Anuile [Tab. 10. fig. 4. [f]. Fig. 5. I. figure. 7 and 8. [b]. Tab. 11, [m]] is the second bone which is situated in the hinder side of the first cauity and lyeth nexte to the Hammer to which it is opposite and couereth (saith *Coiter*) that part of the Membrane which is not couered by the Hammer, yet so that his thicker part is toward the eare and his legges (if we may so cal them) or his thinner parts toward the Tympane. Some are of opinion as *Columbus* and *Archang.* that this bone had his name from his action, because as an Anuile it receiueth the stroke of the Hammer which mooueth aboue it and beateth against it. Others conceiue that it hath the name from the similitude it hath with a Smiths Stithy or Anuile, not that great one wheron they driue sledges of iron, but the little and moo- The Anuile. The reason of the name.

Why called *Dens*.

ble Anuiles which are partly plaine and partly round. And heereupon *Veſalius*, *Euſtachius Coiter*, *Platerus* and *Aquapendens*, becauſe it is not altogether plaine as a great Anuile is, but hath an vnequall cauity ſuch as is to be ſeene in the top of the *Grinding* teeth, haue likened it to a tooth hauing two fangs or rootes, the one longer and ſmaller, the other thicker but ſhorter, inſomuch as they call it not *Incus* or the *Anvile*, but *Dens* or the *Tooth*.

The forme of it.

This bone is ſhorter and thicker then the Hammer (*Aquapendens* ſaith as thick againe) & hath two legges; for in the vpper extreamity it is thicker and ſwelling, and in a ſmooth cauity receiueth the head of the Hammer: it hath engrauen in it a ſmall *ſinus* or boſom, which *Aquap.* calleth an *vnequall cauity*, in the midſt whereof riſeth a Line, as it is in the

The articulation.

bone of the *Cubite* where it is articulated to the Arme, ſo that the articulation thereof is more truely ſayde to bee made by *Ginglymos*, which for the motion is more expedite and ready. And as the head of this Anuile is articulated with the Hammer, ſo the productions or proceſſes thereof doe grow to the orbe of the hole of Hearing, and to the toppe of

The proceſſes.

the Stirrup or third bone. For the lower end thereof which is alſo the ſmaller, doth deuide it ſelfe into two ſlender and acute proceſſes (which *Fallopius* and *Laurentius* with ſome others doe call Legges) ſtanding off one from another.

The higher of theſe which is the ſhorter and the thicker, is ſomewhat broad, a little intorted or bent inward and leaneth vpon the Scaly bone of the Temples, & by a tranſuerſe ligament cleaueth to the walles or ſides of the orbe of the Tympane euen there where the VVatercourſe ſlideth, & by this meanes it is tyed more ſtrongly to the Hammer, that when the membrane hapneth to bee vehemently ſhaken, the two bones might not be ſeparated one from the other.

The other proceſſe of this Anuill or roote of this Tooth is ſomewhat longer, ſlenderer and bending downward; yet ſenſibly intorted vpward it appeareth aboue the membrane and is tyed to the top of the ſtirrup by the mediation of a ligament and affixed thereto by that kinde of coniunction which we call *Arthrodia*, occupying that place of the membrane wherein the Hammer is not, whereby it might *Perceiue* or receiue the pulſion of that part, and communicate the Sound to the ſtirrop, from whence through ſmall holes it is ledde a long vnto the nerue of Hearing.

The ſtirrop.

The Stirrop [Table 10. fig. 4.[t] [p] fig. 8.[r] Table 11.[f]] called *Stapes*, is the third bone of the Eare, which the firſt Inuenters did very aptly expreſſe by this reſemblance.

The Inuéters

Many contend about the Inuétion of this bone; among the reſt *Columbus*, *Ingraſsias*, *Fallopius* & *Euſtachius*, all excellent Anatomiſts and haply all of them as fortunate in the finding it out as they haue been diligent to ſearch into the ſecret corners of man; and therefore we wil not determine any thing in the preiudice of any of them. VVe finde it to be ſcituated as it were in the middeſt of the firſt cauity of the ſtony bone neare the *Ouall window*.

The figure.

In bruite beaſtes it is triangular, very like the greeke letter Δ [Table 10. figur. 8. ſheweth the figure of it in bruite beaſtes] but in men it may bee ſayde to bee formed of two partes, [Table 10. fig. 7. ſheweth the forme of it in men] the one *ſuperior* which is bent like a bowe hauing two ſmal legges ſomewhat ſinuated, which becomming narrow are inſerted into a tranſuerſe Baſis.

The top.

The top thereof is not ſharpe but hath a ſmal plaine and round head, wherewith like an Arch it ſuſtaineth the longer proceſſe of the Anuill, or if you will the Stirrop hangeth to this proceſſe by the mediation of a ligament.

The ſides.

The ſides or Legges of this Stirrop are very ſmall and depart but a little aſunder, making a hole betwixt them more long then round. Some ſay it is Triangular, others of an Ouall forme; but the Baſis of the bone which is the part remaining is tranſuerſe, ſomewhat broad and the edge thereof a little thicker then the other part.

The Baſis.

The Baſis alſo ſhooteth out a little beyond the legges or ſide-bones thereof, whereby it is articulated to the bone at the *Ouall window*, and is firmly faſtned to the membrane which ſhutteth the perforation, and that by the helpe of a Ligament ariſing from that ſide of the

The perforation.

head which hath the cauity. *Varolius* called it very elegantly γλυφοειδὲς as it were the *Pupilla* of the Hearing. And on this manner it doeth exactly repreſent the forme of a Stirrope, not ſuch a ſtirrop as is vſed now a dayes, but ſuch as wee ſee grauen and figured in old pictures aud tables, that is, triangular, and repreſenting the faſhion of the greeke letter Δ.

Why leſſe then the reſt.

This bone is much leſſe then either of the other two, for if it had been bigger or waighed more, then being mooued together with the other two, it would haue drawn the membran

brane downeward. In the middeſt it is perforated or open like a ſtirrop, that it might be the lighter, and that hereunto the Inbred ayre might inſinuate it ſelfe and be mooned. Againe the better to conuay the ſound which it receiueth communicated from the Anuill not only to the depth of the firſt cauity, but alſo beyond to the other cauity, & ſo through the *Ouall window* directly vnto the Labyrinth. Wherefore without this ſtirrop the ſound could not haue beene tranſported into the whole cauity.

For example, as the viſible ſpecies or forme which is receiued within the horny coate must firſt paſſe through the marrow and ſtreight hole of the *Pupilla* or Apple of the eye before it can ariue at the Criſtalline humour: ſo the ſpecies or forme of the ſound which hath gotten into the concauity of the membrane, muſt paſſe vnto the chiefe Organe of hearing through the ſmall hole of the ſtirrop bone: and thence it was that *Varolius*, as wee ſaid euen now, called this hole of the ſtirrop *Pupillam auditus the Apple of the eare.* Varolius.

Why perforated in the middeſt.

Wherefore, as wee ſayd, the formes of ſounds paſſe through the emptie hole of the ſtirroppe into the cauities which are wrought by nature in the ſtony bone where they meete with the Inbred Ayre, which may alſo be compared to the Criſtalline humor. For as the Criſtalline is the chiefe inſtrument of the ſight in reſpect of reception of Images or Formes; ſo is this In-bred aire of the Eare the chiefe inſtrument which receiueth the formes of ſounds, although there bee another more noble Organ which iudgeth of them.

Moreouer, leaſt theſe three bones if they ſhould haue mooued inconſtantly, might haue indangered the membrane to which they are firmly tyed by drawing it too much this way or that way, it is faſtened to the bone with a ſmall ligament or chord, reaching ouerthwart from the ſides vnto the top of the ſtirrop. Yea they are tyed together with ſlender and ſoft membranes which do the office of a ligament, and that by two ioynts which in their extremities are cruſted ouer with a griſtly ſubſtance after the ſame manner that it is in other bones, and ſo their articulation doth not differ from the Syntax or coniunction of other parts.

The reaſon of their connexion.

They were made three in number (though ſome creatures haue but two as *Placentinus* recordeth) for their better motion whereby the membrane is ſecured, which otherwiſe in violent concuſsions of the ayre might haue beene broken. For if it had bene but one bone, the membrane in impulſion could not haue giuen place becauſe the bone would not haue bent therewith; or if the proceſſe of the bone ſhould haue yeelded, being neceſſarily ſo fine and thin, it might eaſily haue crackt a ſunder. Wherefore the membrane of the Tympane is to faſtened ſo the tayle of the Hammer that it might not breake when it is violently driuen inward: And againe the taile or handle of the Hammer cleaueth vnto the membrane that it might not be driuen too much outward. But that it might better reſiſt any violent motion outward or inward there were two other bones added to the Hammer to helpe the flexion; and two muſcles whereby the motion is reſtrayned when the hammer with the membrane is driuen with violence either inward or outward. For the bone which we compare to a Hammer hath a double motion, as *Arantius* elegantly obſerueth, preſsing forward and recoyling backeward.

Why more bones then one.

The double motion of the hammer.

Forward or inward according to the motion of the membrane whereto it is annexed, which membrane being ſhaken by the outward ayre is driuen inward, and vpward remaining ſo long gibbous on the inſide til the Inbred ayre is affected with the ſound, which ayre wandring through the circles conuolutions and burroughs of the eare, maketh the repeſentations of the ſounds to be receiued by the branches or tendrils of the fifth payre of Synewes, by which they are conueyed in a moment of time vnto the Braine. But that this membrane ſhould not be driuen too farre inward, the Hammer oppoſeth it ſelfe. The Hammer determineth at the ſmall cauity of the Anuill whereinto the head of the Hammer is articulated; wherefore the Anuill being a firme and ſtable bone, ſtayeth the inclination of the membrane, euen as ſayth *Arantius*, in clocks there are certaine points of iron which wil not ſuffer the wheele to run beyond the number limited for the time of the day; And as the Anuill is aſsiſtant vnto the Hammer by laying a law vpon his motion; (and therefore hath two legs or proceſſes whereby it is fixed to the ſtony bone and the ſtirrop) ſo alſo the ſtirrop ſtanding vpon the cauity of the ſtony bone neere the circles as it were vpon a ſtable baſis, doth elegantly ſuſtaine vpon his head which is built in the maner of an arch, the longer proceſſe or leg of the Anuill.

Inward.

The ſecond motion of the hammer is outward, for the membrane of the Tympane

Outward.

together

together with the Hãmer when the violence or conſtraint which before bare them inward is remitted do returne vnto their natural ſtation; partly by a naturall motion whereby they recouer their former poſition when the violence is intermitted; partly by the muſcle which is an inſtrument of arbitrarie motion; for that muſcle is contracted toward his originall and ſo the head of the Hammer is ſeparated from his iuncture with the Anuile, and the recurued proceſſe of the Hammer beareth the membrane outward. But beſide theſe twoe bones, the 2. muſcles alſo of the inward eare doe aſsiſt the membrane, one of them againſt the inward impulſion, and the other againſt the outward expulſion.

The ſubſtãce of theſe bones

The ſubſtance of theſe bones is hard, denſe and ſmooth. Hard for that helpeth the hearing, as alſo addeth a greater ſtrength and firmitude vnto the membrane. They are alſo denſe and ſmooth for the better reception and tranſportation of the Sound; yet *Columbus* and *Coiter* are of opinion that the two firſt are within ſpongy and medullous. The third is ſo ſmall that there can be no holes perceiued therein.

How they dif fer from other bones.

And as theſe bones in forme and figure doe differ much from other bones of the body, ſo alſo and eſpecially they haue two notable diſsimilitudes or diſproportions from the reſt.

The firſt is that they are not compaſſed about with the *Perioſtium*, leaſt (ſayth *Aquapendens* and *Placentinus*) they ſhould be vnfit for the reception of Sounds: for if you couer a hard body with a ſoft cloth and then ſtrike vpon it, it will not yeeld ſo ſhrill a ſound as it doth when it is bare or naked.

Againe, herein they differ from other bones as all Anatomiſtes doe concurre, that they are perfect and accompliſhed at the very birth, hauing the ſame magnitude then that they haue in olde age; partly becauſe man at all times euen from his Infancy hath greate neede of the Senſe of Hearing, as wel to learne to ſpeak as to gather knowledge: partly becauſe the membrane of the Tympane is as much ſubiect to danger by outward violence in our Infancy as in any time of our life. Notwithſtanding they are not ſo hard in Infancy as in old folke, for children are full of moyſture: whence it is that children do not heare ſo ſuddenly as grown men, becauſe to the exact perfection of the Sence there is required a notable drineſſe.

Why children do not heare ſo well as grown men.

Aquapendens addeth a third difference betwixt theſe bones and other bones of the body: for, ſayeth hee, theſe bones of the Eare doe hang ſuſpended from a membrane. Whence it commeth to paſſe that the externall aire together with the ſound is more eaſily communicated by the Hammer and the Anuill to the aire implanted in the eare: for Soundes are more liuely communicated to hard bodies, which hang looſe as you may perceiue if you tie a peece of Iron to a ſtring and ſtrike vpon it, it wil yeeld a ſhriller ſound then it will if it be not ſuſpended. But this conceit of *Aquapendens* ſounds but harſh in *Placentinus* eares.

Why they are hollow.

Theſe bones are alſo hollowe, as well to make them the lighter, as alſo to containe Marrow for their nouriſhment, whereto we may adde, that that which is hollow maketh a better reſonance.

Their vſes.

And albeit theſe three bones are of all others the leaſt in quantitie, yet by that which hath beene ſaide, we may conceiue that they are of great vſe and neceſsitie. In a word, their vſes are firſt to eſtabliſh and defend the membrane of the Tympane, leaſt it ſhould be torne either by inward windes gathered in the brain, or by the violent motion of the outward aire, as in thunder, ſhooting off Ordinance, or ſuch like.

Secondlie, they yeeld ſome aſsiſtance vnto the Senſe of Hearing, for by their help the Sound is conuaide by a kinde of conſequence or ſucceſsion to the auditorie Neruc. For vpon their commotion the Chord is ſhaken, the implanted aire is moued to receiue the Sound. Now the Chord could not haue beene ſo vehemently moued by the membrane alone as by the membrane and the bones; and ſo theſe bones together with the Chord being ſhaken by the appulſion of outward aire, doe conferre vnto the diſtinction of Sounds as the Teeth doe to the explanation of the ſpeach.

Anatomiſtes are here at a loſſe.

I am not ignorant that many men haue buſied themſelues to finde out the particular vſe of each of theſe bones, wherein what ſatisfaction they haue giuen themſelues, I know not; certainely to vs that reade their writings they giue but little. Their conceites being meere ſpeculations, & ſo intricate for the moſt part as if they did vnderſtand what they would haue ſaide, yet they haue not beene able to expreſſe themſelues vnto others. *Coiter* me thinks reſolueth very well that their exact hiſtorie eſpecially, for the vſe, is not

ſo

ſo curiouſly to bee ſought into, becauſe it is impoſsible that wee ſhoulde attaine further then a bare coniecture, and beſide ſomething would be left by vs for admiration, eſpecially where our vncertaine gueſſes cannot bring vs any great profite ſauing the ſatisfaction of an ouer curious conceite.

It remaineth that we ſpeake of that ſlender and neruous Chord which is within the membrane. It doeth not indeed compaſſe the membrane round about, but running thorough the middeſt thereof is faſtned to that ioynte where the ſtirrop is articulated with one of the Legges of the Anuill. This Chord if it be drawn out is thrice or foure times as long as it appeareth before it be drawne. For the ſubſtance *Euſtachius* taketh it to be a branch of the fourth coniugation. *Fallopius* ingenuouſly confeſſeth that hee knowes not what to cal it, yet reſolues to giue it the name of a Nerue, and with him *Coiter* conſenteth. *Ingraſsias* calles it a thred or a chord: *Aquapendens* a ſlender rope of the Nature of a Ligament, or, ſayth he, if it be not ſo nor any of the other aboue named, then is it a body of his owne kinde. The Chord. Diuers appellations.

Howſoeuer it be framed or of whatſoeuer, the vſe of it ſeemeth to be for pulſation, for as in a Drumme the ſound is made by the repercuſsion of the chord which is ſtreatched ouer the Vellam or the Skin, ſo in the eare ſayeth *Coiter* this chord receiuing an impreſsion by a beating made vpon it from the three bones, doth ſtrike the inward ayre whereuppon Senſation is made. The vſe of it.

CHAP. XIX. *Of the Muſcles of the inward Eare*

THE Hammer beeing articulated to the Anuill with that kinde of articulation which we call *Ginglymos*, it followeth that their motion muſt be very obſcure, now they are moued together with the membrane at which the Hammer hangeth, vpward and downeward hauing one muſcle appointed for this motion within the membrane, another ſeated without it.

The internall muſcle [Table 11. figu 2. i] deſcribed firſt by *Euſtachius*, and ſcituated in the ſtony bone, is exceeding ſmall, there being in the whole body none leſſer: and yet the frame thereof is ſo elegant as no muſcle in the body may bee compared thereto. It ariſeth in the Baſis of the wedge-bone in that place where there is a hole made with a root of the proceſſe of the ſtony bone, and an additament of the nowle-bone. The internall muſcle.

It taketh his originall from a ſubſtaunce much like a Ligament. Afterward it becommeth fleſhy, and groweth a little broader euen to the verie middeſt. Afterward it is againe anguſtated or ſtraightned and produceth, *Euſtachius* ſayth but one Tendon. Whome *Coiter* and *Aquapendens* do follow. But *Placentinus* & according to him *Bauhine* ſay, they are two, very ſmall, [Table 11. fig. 5. below i] one of which is inſerted into the vpper proceſſe of the Hammer, the other into the necke thereof. But in Dogges a little before the inſertion it hath a fleſhy and round glandule a little depreſſed, which is not fixed to the membrane leſt if it were drawne by it ſelfe being very ſmall it ſhould be in danger of breaking. His originall and progreſſe

This muſcle when it worketh draweth the head of the Hammer obliquely forward, and inward deduceth or inclineth it from the Anuill, and bending the proceſſe of the Hammer driueth the membrane outward.

That this is the vſe of this muſcle *Arantius* proueth by an experiment on this manner. If, ſayth he, in a greene head that is well diſſected till you come to this part, you drawe this muſcle with a ſharpe hooke toward his originall you ſhall finde it hath a double vſe: one that the head of the Hammer will manifeſtly recede or depart from the Anuil and be lifted vp, the other that the membrane will be driuen outward. The vſe of it according to *Arantius*.

Now this motion which is made in the eares although it ſeeme to bee voluntary, becauſe it is accompliſhed by a muſcle which is an inſtrument of voluntary motion; yet it can hardly be perceiued by our ſelues, yea wee heare whether wee will or no, the reaſon is becauſe the muſcle is ſo very ſmal.

Neither doe we want examples of many muſcles whi ch we know aſſuredly doe worke as well while we ſleepe as while we wake, which yet wee cannot obſerue in our ſelues, but their motion ſeemes to be without our conſent, as we may inſtance in the muſcles of Reſpiration, of the eies, of the eie-lids, the bladder and the fundament. Yet in ſome men this motion is more euident, which alſo they can at their pleaſure moue or containe. The truth of this *Aquapendens* proueth on this manner. The motion ſayth he is Senſible, and with a kinde of noyſe, as if a man ſhould ſtretch three threds a little diſtant one from another, and ſtrike them with a Cittern quill as we do ſtrike an inſtrument; or as if a man ſhould ſcratch *Aquapendens* his demonſtration of the motion of the muſcle.

ouer-

ouerthwart the graine of a wanſecoate, or imagine it to bee like the noiſe that the Steele makes when you ſtrike fire out of the Flint. This motion is eſpecially perceyued vvhen a man begins to yawne, but in the beginning of it we heare a kinde of obſcure or dull ſound from the commotion of the aire, much like the noiſe that a ſtaffe makes when it is beaten againſt the aire. But this motion or noiſe in the aire many men do not obſerue, neyther doth it ſeeme to me ſaith *Placentinus*, to haue any vſe or to conferre at all to the Senſe of Hearing; for if there be a noiſe in the aire and at the ſame time a man ſhall ſtriue to ſtirre vp this motion, he ſhall heare the outward noiſe more imperfectly. And therefore this motion ſeemeth to happen either from the neceſsity of the matter, the Muſcles neceſſarily following the attrition of the Hammer againſt the Anuile, or elſe it was ordained by nature for the auoyding of vapours. For in Agues wherein many vapors do ariſe vnto the head this noiſe is frequently heard, which wee conceiue to be when as the vapours which fill the cauity of the eares are by this motion diſlodged, and yet we may vnderſtande that this motion is not altogether at our owne diſpoſition.

Bauhines demonſtration thereof out of the experiẽce in himſelfe.

In like manner ſaith *Bauhine* when the Eares are purged into the mouth by the paſſage that way opened, I am woont to perceiue in my ſelfe a kind of tickling within my mouth neere the roote of the *Vuula*, at which time if I often ſwallow my ſpittle, I doe manifeſtly perceiue by the noiſe that that motion is ordinarily ſtirred vppe in mine eares: and I perceiue likewiſe the foreſaide tickling to bee appeaſed when the matter by that meanes is ſooner purged into my mouth.

It is leſſe in great Beaſtes then in men.

But how commeth it to paſſe that this motion is perceiued in both the ears at once? It may bee anſwered, that it happeneth in the eare as it dooth in the eye: for vvhen one eye is mooued, the other alſo inſtantly accompanieth it, as wee haue ſhewed before. A man would imagine that in large bodyed creatures this Muſcle might be better perceiued then in a man. But we find it farre otherwiſe; for although beaſts haue it, yet for the moſt part it is in them leſſe and harder to finde then in a man.

How to finde this Muſcle.

Hee that is deſirous to finde out this Muſcle, muſt lightlie cut the Stonie proceſſe thoroughout the length, guiding his Knife by a Line which runneth there-through but not very high, beginning at that part of the proceſſe which is next vnto the Wedge-bone, for the muſcle runnes length-wiſe and ſo determines into the membrane of the Tympane.

The other Muſcle with-out the membrane.

The other Muſcle [Table 11. figure 1 and whoſe inſertion is at [b]] is ſituated without the membrane of the Tympane in the vpper part of the hole of Hearing about the middeſt thereof. Concerning the inuention thereof two excellent Anatomiſts of *Padua* in *Italy* doe contend. For *Hieronymus Fabritius ab Aquapendente*, whome therefore we call *Aquapendens* affirmeth, that he found it in the yeare 1599. But *Iulius Caſſerius Placentinus* auoucheth, that he obſerued it the ſeauenth day of March, in the yeare one thouſand fiue hundred ninety three. But out of queſtion they both haue deſerued wonderous well of this Art which of them ſoeuer was the firſt inuenter thereof.

Bauhins honorable remembrance of *Aquapendens* & *Placentinus*.

And becauſe, ſayth *Bauhine*, I would haue the world know how much I eſteem them both, I will ſet downe both their deſcriptions thereof beginning with *Aquapendens*, becauſe he is the Ancienter, not to derogate from the other, ſeeing I loue and honor them both. The one was my maiſter in the yeares one thouſand fiue hundred ſeuenty ſeuen, one thouſand fiue hundred ſeuenty eight, and one thouſand fiue hundred ſeauentie nine: the other in the yeare one thouſand fiue hundred ſeuenty nine was my friend and fellow-Studient, and this friendſhip to this day we maintaine by entercourſe of Letters, and ſhall do I doubt not ſo long as we liue. *Aquapendens* therefore hath it thus.

Aquapendens his deſcriptiõ of this muſcle.

Furthermore, this yeare 1599. I found a muſcle in the hole of hearing, cald πορὸς ἀκυστικὸς [Tab. 10. fig. 9] which is without the membrane very ſmall, fleſhy and not without a tendon which proceedeth directly from the midſt of that hole or paſſage, till it be inſerted into the very center almoſt of the membrane on the outſide iuſt againſt the place where the Hammer on the inſide is faſtened to the membrane, which together with the Hammer it draweth outward. You ſhall finde this newe muſcle if in a greene head you cut the vtter Shell of the Bone which maketh the *Hole of Hearing* on both ſides, which you may beſt do with a Chizell and a Mallet and ſo remooue the bone carefully to the ſides, for ſo the Muſcle will appeare, and yet I haue not bene able to finde it in all my latter diſſections, although I eſteeme the neceſsity of it to be ſo great that I thinke it was rather the fault of my dilligence then a defect in Nature. Thus farre *Aquapendens*.

Pla-

Placentinus deſcribeth it on this manner.

In a man there is another Muſcle ſituated in the vpper part of the hole of Hearing, [Tab. 11. fig. 1, a b] about the middeſt whereof the skinne and the Membrane which being implicated or folded together do inueſt the ſaide hole, do euidently degenerate for the forming of this Muſcle into a fleſhy body: but almoſt membranous, diſtinguiſhed or lined through with Fibres, hauing alſo a Tendon. The Figure of the muſcle is round and in the progreſſe groweth ſlenderer by degrees, and ſo paſſeth directly on vnto the Tympane. It is inſerted not into the outſide of the Membrane nere the center; but the Tendon (which it tranſmitteth with a double extremity or termination into the cauitie of the ſtony-bone betwixt the Tympane and that part of the temple-bone from vvhich the bonie ring proceedeth) is faſtened on the inſide into the heade of the Hammer, betwixt the vpper and the lower proceſſes thereof. The inuention of this Muſcle if I attribute to my ſelfe I ſhall not defraud any man of his due commendation, for I obſerued it the ſeuenth of March in the yeare 1593. in the preſence, &c. Thus far *Placentinus*.

Placentinus deſcription.

The vſe as well of the Internall as of this externall Muſcle *Aquapendens* thus expreſſeth.

Aquapendens his opinion of the vſe of the Muſcles.

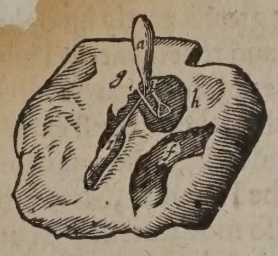
The vſe of theſe Muſcles is for the ſecuritie of the Membrane, for becauſe it might haue bene broken or torne either on the inſide or the out, Nature prouided a ſtrength

Table 11. *Sheweth the Muſcles placed in the cauity of the eares, with ſome other cauities and bones of the eares.*

TABVLA. XI.

FIG. I.

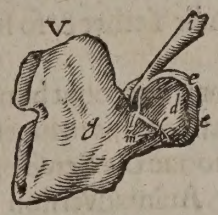
FIG. II.



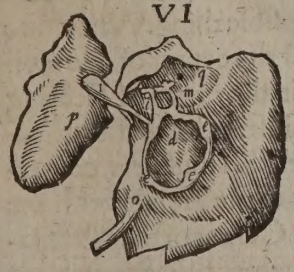
III

IV

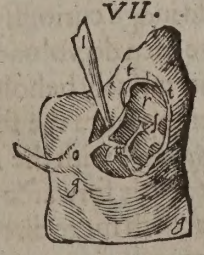
V



VI



VII.



IIX

IX

a,b. The externall Muſcle whoſe inſertion is at *b.*

c. The Hammer of the Tympane couered with the Membrane.

d. The membrane of the Tympane.

e. The bony Circle.

f. The bone called *Maſtoides.*

g. The Temple bone.

h. The circle of the firſt cauitie.

i. The internal muſcle whoſe bifurcated tendon is ſhewne in the fift figure.

KK. A portion of the *Pericranium* or ſcul-skin going vnder the bony Circle, making the membrane of the Tympane or Drumme.

l. The Hammer lying vnder the membrane.

m. The Anuile.

n. The breach of the bonye circle at *e* vvhere the beginning and termination of it is.

o. A part of the yoake bone.

p. A part of the bone called *Baſillare.*

q,r. The firſt cauity.

ſ. The Stirrop.

tt. The Circumference of the Shell called *Concha.*

u. A protuberation or ſwelling in the middle of the Cauity.

or

or defence in both places. For on the outſide the aire beeing violently mooued might haue broken the membrane by thruſting it inward, and on the inſide by beating it outward; in the outſide the externall aire which with violence togither with the ſound ruſheth into the eare; on the inſide the aire which thorow the mouth getteth into the eare doth forcibly ſometimes driue the membrane from within outwarde; and in this manner is the membrane ſtretched ordinarily in yawnings, blowings of the noſe, retention of the breath, ſtrong contentions, lowd voices, the excretion of excrements, and ſuch like violent conſtraints. The externall Muſcle therefore when the Membrane is driuen inward draweth it backe, and as it were recalleth it into the right place. In like manner, the internall Muſcle retracteth it inward when it is turned or driuen outward. And theſe are the neceſsities for the ſatisfaction whereof Nature ordained theſe two elegant muſcles, to wit, for the preſeruation of the Membrane.

The reaſon why the cuſtodie of the Membrane was committed to a Muſcle, that is, to an inſtrument of voluntary motion is rendred on this maner. If any other tie but that of a Muſcle had bene made the *Cuſtos* or *Vindex* of this Muſcle, ſuch a tie muſt haue held it alwayes ſtretched or tentred alike, and ſo the Membrane would rather haue bene more endangred then any whit ſecured. Beſides, it was verie neceſſarie that as the impulſions of the aire vnto the Membrane are diuers, ſo there ſhould be a varietie of power in that that was to curbe or limmit thoſe diuers motions or impulſions. Such a varietie of power cannot bee imagined to bee in anie Ligament but onely in Muſcles which make their operation with a certaine Analogie or proportion to the finall end which Nature entends, or according to meaſure; contracting and relaxing themſelues more or leſſe as neede ſhall be, accommodating their motion diuerſly according to the diuers impulſions of the aire; for they ſuffer the Membrane onely ſo to receiue the offered violence, that neither the violence might be altogethet withſtood but that the membrane might yeeld therto, nor yet the Membrane be outraged by ſuch violence. In a word, theſe muſcles partly by yeelding and giuing groũd, partly by obluctation or oppoſition do ſecure the Membrane from being torne and rent aſunder. Thus far *Aquapendens*.

Placentinus opinion of the vſe of the muſcles.

Placentinus thus. The Muſcles of the inward eare doe one of them aſsiſt the Hammer againſt internall impulſions, the other againſt externall. The outward muſcle which I founde out, that ſendeth his Tendon into the cauitie of the Stony bone and ioyneth it ſelfe with the greater proceſſe of the Hammer, draweth that part of the Hammer outward which inclineth inward, and ſo moderateth the compreſsion thereof made vppon the Anuile, that it is a defence againſt the internall Muſcle.

The Internall which ariſeth from the Wedge-bone and paſſeth into the cauity of the Stony-bone vnto the Head of the Hammer into which it is inſerted, ſuccoureth the ſame againſt the former when it is driuen inward, defining and limiting his introceſsion. For when the Tympane by an irruption of outward ayre, is together with the Hammer driuen inwarde, this muſcle reſiſteth their motion that the Tympane and the Hammer ſhould not be conſtrained beyond their Tether & ſo ſuffer laceration. Thus farre *Placentinus*.

Varolius his vſe of a muſcle in the ear.

Varolius concerning this matter (for we account him alſo among our claſsicke authors, eſpecially concerning the head) writeth on this manner.

Although, ſaith he, the ſound do mooue the Senſe of Hearing whither wee will or no, yet there is in vs a kinde of voluntary Animadverſion which wee exerciſe in all our ſenſes at our owne pleaſure when we would iudge curiouſly of any ſenſible thing. Wherefore as by the helpe of the muſcles of the eye men do voluntarily direct the center of the Criſtalline toward the obiect which they attentiuely behold, ſo within the organ of Hearing there is placed a ſmall muſcle, which ariſing from the fore-part is inſerted into the articulation of the triangle (ſo he calleth the *Stirrop*) with the Anuil: when this muſcle is contracted, the Triangle or Stirrop is drawne a little forwarde, the ioynt of the Anuile vvith the Hammer yeelding thereto, and approacheth more directly to the Center of the Tympane, and at that time we heare with more attention and better iudgement, like as wee are able to ſee the leaſt viſible obiect when we ſtedfaſtly beholde it by a line concentricall to the *Horny Membrane*, the *Pupilla* and the *Criſtalline humor*. Some haue imagined that the ſmall bones of the eares diuerſly mooued by this muſcle, doe make within the organe of Hearing many and different ſorts of ſounds, whoſe opinion we thinke ſufficiently confuted by the former aſsignation which we made of the vſe of the muſcle. Thus farre *Varolius*.

CHAP.

CHAP. XX. *Of the Cauities of the Stony-bone.*

ALbeit wee purpoſe in the Booke of Bones as particularly as wee can to follow their hiſtory; yet becauſe this Stony bone and the diſſection thereof is moſt neceſſary for the vnderſtanding of the manner of the Senſe of Hearing. VVee haue determined to make our particular deſcription thereof in this place; and to paſſe it ouer with little more then bare mention in the booke of Bones. Why we intreat of this bone here.

Although therefore (as before is ſayd) the Stony bone is within altogether *Cauerqous* and ſpongy, and that the Antients haue made mention of one only Denne or Cauity there in: yet wee will reckon vnto you three notable ones and of great moment, which alſo the *Neotericks* or later Anatomiſtes haue called *Dennes* and *Caues*.

Theſe Dennes or Caues are formed in the middeſt of the ſtony-bone where it ſwelleth moſt, to contayne the Organs of Hearing, that is to ſay, the mẽbrane, the three ſmal bones, the internall muſcle, the chord, the auditory nerue and the in-bred ayre, which alſo is called the internal *medium* of this Sence. All which Caues may more diſtinctly and diſtrictly bee demonſtrated in children, then in growne men. *Placentinus* findes them alſo verie conſpicuous in Birds. They haue each of them proper names borrowed from externall things: the firſt is called *Concha* or *Tympanum*, becauſe it is like the ſhell of a winke or a Taber. The ſecond is called *Labyrinthus*, becauſe of the turnings therein. And the third is called *Cochlea*, becauſe it is like a Snailes ſhell. 3. Cauities. Their names.

The firſt [Table 10.fig.2 [h] from [c] to [g] Table 11.[gf]] cauity is layd open, when the membrane of the Tympane is taken away. It is called *Concha*, as we ſayd euen now, becauſe it is like a VVinkle or Periwinkle, ſo acknowledged by *Aquapendens*, *Placentinus*, *Arantius*, & our Authour *Bauhine*, although I knowe there is great contention againſt *Ariſtotle* in this point, who ſeemeth firſt to haue giuen this name to this cauity. But wee ſtand not vppon names ſo much, ſo we know the thing ſignified by the name. The better appellation as me ſeemeth is a Tympane, becauſe this cauity couered with his membrane reſembleth a Drumme or Taber, for when the membrane is ſtrucken by the Sound it reſoundeth again as a Drumme if it bee beaten by reaſon of the ayre therein contayned rendreth a great ſound. The firſt cauity. The reaſon of the name.

Coiter reprehends *Fallopius* and *Platerus* for this appellation, becauſe, ſayth hee, in this cauity there are holes, & windowes, and diuers windings which a Drumme hath not. To whome we anſwere, that in men it hath the name of a Drumme or Tympane from the vſe; but in bruite beaſtes not onely from the vſe but alſo from the figure becauſe in thoſe creatures that chaw the Cud it is very like to a Turkiſh Drumme. This cauity is alſo called by *Coiter* and *Placentinus* the *Baſon* and the *Denne*. It is excauated or hollowed in the beginning of the ſtony-bone, betwixt the roots of the *Mammillary* proceſſe, and the place where the head of the Iaw is inſerted or faſtned to his ioynt. The vtter part thereof regardeth the hole of Hearing from which it is onely ſeparated by the membrane [Table 10.figu.2.from [h] toward [c].] *Coiters* obiect. Anſwered.

Hence it is that if the inſide of the eare be inflamed or vlcerated, vppon the motion of the lower iaw the patient is payned in his eare. Note.

The inner part of the cauity is by a thin ſcale diſtinguiſhed from the hole of the ſleepy artery [Table 10.fig.2.from [h] to [i].]

This firſt is the greateſt cauity of the three, and by a ſucceſsiue ingreſſe or continuity of paſſage is ioyned with them, by which meanes it is able to containe a greater quantity of in-bred ayre, & alſo receiue at the ſame time diuers ſounds comming from diuers quarters.

But becauſe the internall ayre muſt firſt be mooued by that which is without, and then tranſport the image of that ſound wherewith it is moued to the Auditory nerue, it was very neceſſarie that it ſhould be purged and kept pure from any ſtayn of corruption, that like a neate glaſſe it might repreſent the image offered vnto it. For this purification and expurgation of the inward ayre, Nature hath placed in this cauity diuers inſtruments: ſome ſeruing for Pulſation, ſome for Traiection, and ſome for Expurgation. For Pulſation ſerue the three bones, the chord and the muſcles. For Traiection or conduction vnto the other cauities ſerue two perforations commonly called *Feneſtellæ* or the VVindowes. For Expurgation there is a paſſage which leadeth into theſe pallat. All the particles did require a large cauity; whence it was that Nature framed this ſtony bone long and round, that ſo it The organs in this cauity.

Why this is single.

A witty conceit of *Aquapendens.*

might containe the more. Furthermore, this cauity is but single, whence it comes to passe that though there be many noyses made together, yet they are at the same time receiued. For if this first cauity had bene distinguished into many dens, neither would the sounds haue bene receiued at the same time nor after the same manner intertained and iudged of by the faculty, for the diuersity of reception would also haue induced a diuersity of apprehension, as *Aquapendens* very wittily hath obserued.

The fashion of the cauity

The interior superficies or inner surface of this cauity is vnequall, being in some parts depressed and thrilled through, in others knotty and swelling. Immediatly behinde the membrane it runneth vpward toward the forepart, where also it becommeth narrower, afterward it is dilated and tendeth backeward toward the top; then as if it were another cauity it is produced or lengthened downeward; which part saith *Coiter*, in a man is like a bladder. [Tab. 11. fig 8. and 9.] In a calfe like a waggeners budget, in a kid and lambe like a market womans pouch. It is also rough and spongy; rough, that it might receiue the sounds and not reflect, returne or double them, for if it had bene leuigated, that is, smooth and equall like the arch of a Church, it would haue returned an Eccho. Spongy also, that if at any time the noyse should happen to bee so strong that it might offend the hearing, the force thereof might be abated in those small holes. Moreouer, in that spongy porosity the Inbred Ayre is laboured and brought to perfection. But when I say, it is spongy, I would not haue you conceiue that it is soft as a sponge but porous, for otherwise it is exceeding hard and stony, thereby yeelding and returning a quicker sound.

Why porous or spongy.

How lined.

Againe some parts of this cauity are lined ouer with a membrane produced from the *Pericranium*: for after the *pericranium* hath framed the membrane of the Tympane, it is duplicated and diuersly diuided, so as some of it doth inuest certaine parts of this cauity.

The necessity of the parts of this cauity.

But because this cauity was destined for the reception of the implanted or Inbred Ayre, which was to receiue the outward Ayre altered by the sound, it was very necessary that it should receiue some kind of percussion: but being by the membrane distinguished or diuided from the hole of hearing, it could not receiue the alteration of the outward Ayre without some other helpe, which helpe is pulsation, and that pulsation is accomplished by the three bones, the chord and the muscles.

Now that the internall Ayre being affected by the pulsation of the outward Ayre altered by the sound, might carry this affection vnto the sense, there was made certaine canales wherein the inward Ayre might be conuayed vnto the Auditory nerue, to wit, the two *Windowes* with a passage into the *Labyrinth*. Furthermore, it was also necessary that this implanted Ayre should be preserued pure, as also bee cherished and sustayned by the Ayre which we draw in at our mouthes, to which purpose Nature hath created a canale or passage out of this cauity into the pallate, by which it is purged and receiueth new Ayre for his perpetuall nourishment. Of the instruments seruing to pulsation, we haue entreated at large in the seuenteenth & eighteenth chapters; of those seruing for expurgation very particularly in the nineteenth chapter; and both we haue repeated in this. It remaineth now that we prosecute those Organes which serue for Traiection or transmission of the affected Ayre vnto the auditory nerue, and so to the first sensator.

CHAP. XXI. *Of the two windowes called Feneſtellæ, and the watercourse in the first cauitie.*

The first.

IN this cauity there are two holes very small, which some men call *Feneſtræ* or *Feneſtellæ* the windowes. These regard the orbe of the hole of hearing as from a higher place. The first which is the foreward and the higher and looketh toward the face, [Tab. 8. fig. 4. and 5. F. Tab. 10. fig. 2. k.] being as it were in the middest of the cauity, is of an Ouall figure or like an Egge, and therefore is it by some Anatomists called *Feneſtra oualis*, the ouall window.

Feneſtra oualis

It is somewhat long and flatted on the sides, and in the backe side it openeth it selfe into the *Colchea* or the last cauity with a large mouth and becommeth so like the forepart of the *Colchea* that a man cannot tell whether that this Ouall window open into the *Colchea*, or the *Colchea* into it. This also ioyneth it selfe with the posterior hole, and passing inward is dilated, and maketh as it were a Market place or is like the cauitie of a mettall Mine, (for thus the Anatomists haue pleased to compare little things with great) from which many streets, wayes or burroughs do runne. Vpon this lieth the basis of the stirrop, and for the most part closeth it vp.

The other hole or window is the posterior and lower. [Tab. 8. fig. 3. 4. G. Tab. 10. fig.

2.[l].] It is rounde and leſſe then the former and ſomewhat narrower in a man; but in a Calfe and a Sheep ſayth *Placentinus* it is ſomewhat larger, and a little extuberating or bunching out; alwaies open it is and declining toward the backeſide of the cauity, and yſſueth together with the former through the bone making a double canale.

Betwixt theſe two windowes [Table 10.figur.2.[k] and [l]] aboue the lower hole is there a little knub or protuberation, which together with the round hole and the ſtrutting bunch placed vnder the vpper part, may be compared to the little boſſe (ſaith *Placentinus* and before him *Veſalius*, *Coiter* and *Platerus*) wherewith they vſe to adorne the cheeks of a horſes bit. In this knub lieth the chamber of the third cauity which is called *Cochlea*, of which wee ſhall heare more in the next Chapter.

The vſe of theſe windowes is, by pulſation to receiue the ſound communicated to the implanted ayre, and to tranſmit the ſame to the other cauities that follow. Their vſe.

The lower hole is cleaued into a double pipe which lie one vppon another [Table 10. figu.2. i i] and are deuided onely by a thinne bony ſcale, the one of them together with the Ouall window paſſeth to the *Cochlea*, the other goeth into the Labyrinth or the ſecond cauity of the ſtony bone. The more forward of theſe admitteth a ſurcle of the Iugular veine, and ſendeth out a braunch of the firſt coniugation. The *poſterior* is compared to a Water-courſe [Table 8.fig.3.[n] Table 10.figu.2.g] becauſe it is like the pipes wherein water is conuayed, imagine it to be in a Serpentine Still, ſome call it the Saylie pipe. The Auntients and *Galen* call it *Cæcum meatum* the blinde paſſage, others *Capreolaris*, that is writhen or intorted, not becauſe it is blinde, but becauſe if you put a Hogges briſtle into it, it will hardly finde an yſſue. And truely in the dry skull of an Oxe you cannot finde way for a briſtle by any meanes. The water-courſe.

It paſſeth writhen, firſt forward, then backward and obliquely aboue the hole of the firſt cauity. From thence turning downewardes it determineth into the fift hole of Hearing, [Table 10.figu.2.αβγδ] it is full of holes. In the beginning is that which is marked with [α] common to it with the vpper part of the paſſage of the auditory nerue. Afterward in the middle of the paſſage on the outſide in the forepart of this canale [δ] it maketh the *fift hole of Hearing* and letteth fall an arterie; ſo alſo in the inſide [γ] at the beginning of the ſecond cauity it opneth it ſelfe. In the end alſo it hath another hole [β] which determineth into the 3. bone of Hearing. Through this canale is the greater part of the auditory nerue as alſo an artery diuerſly deduced and dilated. For becauſe it was neceſſary that the branch of the nerue of the fift coniugation ſhould grow hard, it was alſo fit it ſhould be conuayed thorough the hardeſt, drieſt and moſt torted paſſage, eſpecially ſeeing there was no other way where through it might be conuayed. The paſſage of it.

CHAP. XXII. *Of the Labyrinth and the Cochlea or Snaile-ſhell, that is, of the ſecond and third Cauities of the Stony Bone*

THe ſecond Cauity becauſe it is full of windings and turnings like a Conny-burrough, is called *Labyrinthus* and the Mine. It is inſculped or excauated in the *poſterior* and *anterior* ſides of the ſtony bone or in the root of his proceſſe, and is diſtinguiſhed or deuided from the hole of the nerue of Hearing, onely by a thinne ſcale. [Table 10.fig.2.betwixt [m] and [c]] It is round and leſſe then the former: and when it hath (vnder the knub and behind the Oual window) ioyned it ſelfe to the following cauity; attayning inward it is dilated & maketh as it weere a Market place, or the broad floore of a Mettall Myne as before is ſayde; from which many wayes run out, which proceeding thorough the hard ſubſtance of the bone like a hollowed circle, doe againe returne into a large Chamber. The 2. cauity. The forme.

Theſe wayes we call burroughes with *Fallopius*, *Coiter* and *Platerus*, or with *Placentinus* bony Semicircles. [Table 8.fig.4.and 5.[nnn] Table 10.fig.2.[m] 1.2.3. and particularly [m] with the Characters 1.2.3.fig.6.V] Of theſe we make three, which do ſo paſſe that two of them do twice interſect thẽſelues with right angles, but the more manifeſt interſection is made aboue the top of the third cauity where the hole endeth which receiueth and tranſmitteth the nerue of the fift coniugation. *Cuniculi.* The interſections.

In their originall they are ample or large and become narrower by degrees, becauſe it was not fit that the Sound ſhould paſſe through a broad ſpace; afterward running through the ſubſtance of the bone in circular reflections, they returne to their beginning, yet ſo that in their whole progreſſe they neuer manifeſtly open one into another.

The first. One of these is the lower which runneth from the forepart of the cauity diuerting or turning aside outward yet still in the same cauity, afterward it is reflected and runneth thorough the *posterior* angle.

The second. The second issueth out of the same *anterior* angle, and arising vpward after it hath made a semicircle, it returneth through the *posterior* angle.

The third. The third ariseth and determineth in the backeward angle of the cauity: for beginning there it perforateth the bone with a circular cauity tending outward, and so returneth thither againe. And all these in young Infants may be separated whole from the cauity and from the crust wherewith the bone is lined, but in time they grow stony & are vnited. These canals or burroughes could not be made long because of the shortnesse of the stony bone, although it had beene very profitable, because length maketh the sound bee better perceiued. VVherefore Nature recompenced their shortnes with circumuolutions, and indeed the gyrations do better helpe the Hearing then length would haue done, because in them as it were by degrees the sound is by little and little laboured, and ascends broken and diuided into the braine. Furthermore, the burroughes in their inward superficies are inuested with a very soft and fine membrane.

The reason of the meanders

Their perforations. These burroughs by their egresse and regresse into this cauity make sixe holes: beside, from the first cauity into this are two holes, and moreouer certaine small ones from the lower hole of the auditory nerue and from the common canale. [Table 10. fig. 2. γ] The cauities or holes, saith *Aquapendens*, are so innumerable and intricated one with another, that it may well be called a Labyrinth. For their number they are rather to be admired then numbred, neither can a man finde any order in them, and if any man shoulde attempt any such thing, it were a worke of a vaine and addle witte, albeit *Placentinus* thinketh it fæsible. For cutte any parte of this bone, and beside the vtmost crust you shall finde the rest of the whole bone to be full of holes, pores and dennes, yea altogether spongy, as is touched partly before.

The vse of conuolutions. The vse of the Conuolutions and Meanders is, that the sound being conuayed through so narrow passages might be more sharpe and not bee dissipated; and this wee may see in Instruments of musicke, for a Flute or Cornet by how much it is the longer and the narrower, by so much is their sound more shrill: the reason is, first because the ayre remayning quiet and at rest in the canale doth more easily receiue the alteration proceeding from the sound then it would doe if it had scope wherein it might be troubled and disturbed. Again, the aire concluded in a narrow roome is not dissipated but vnited, and so remayning yee leadeth a greater and quicker representation of the sound vnto the nerue, then it would do if it were dispersed.

The third cauitie. The third cauitie is called *Cochlea* or the Snaile-shell from the sinuing obliquitie of his passage; which elegantly resembleth the winding of a Snayle or Periwinke shell [Table 8. fig. 4. and 5. O Table 10. figu. 2. vnder n] especially if you take off the vpper part of the shell till you come to the narrower part thereof where the scruing begins to be thick. *Vesalius* calleth it *Antrum Buccinosum*, the Den like a Trumpet. The Antients called it the blinde hole or the blinde cauity, because they thought it had no through passage. But the truth is, that though it be much intorted and writhen, yet it hath an yssue in the middest, in that place where the gyrations are fastned from the beginning to the end, and this yssue is narrow and direct. For if this cauity had beene blinde without an out-let, the ayre being beaten could not haue attained to the nerue of Hearing.

The appellations.

This is farre lesse then the former two, scituate in the forepart of the processe vnder the knub of the first cauity, that it might meet with the Soũd which proceedeth from behinde forward, and is distinguished from the canale, which wee sayd was like a watercourse (placed in the middest of the stony processe) by a thinne bone like a bridge [Table 10. fig. 2. betwixt n and f.]

Where situated.

It is long and crooked and hath three gyrations sometimes, sometimes foure, one of them receiuing another after the manner of the *Cochlea* or Snaile-shell, by which it is intorted somewhat inward and downeward. But the broader scrue standing highest receiueth the nerue; the narrower standing lowest determineth in the cauity of the bone, and worketh it selfe also a passage. Into this endeth the hole of the first cauity called *Fenestella oualis*, which *Platerus* calleth the lower hole and *Placentinus* the vpper [Table 10. fig. 2. l] I meane into the greater gyre of this bone.

The figure.

This bone of the *Cochlea* or the Snaile shell consisteth of two kinds of circles, whereof one

one is made of a bony ſubſtance very thin and dry, which may eaſily be crumbled, and on euery ſide like a Snake rowled vp into boughts. The other was firſt propounded by *Euſtachius*, which is made of a ſoft & mucous matter yet firme, and hath I know not what kind of ſandy matter mingled therewith. It ariſeth out of the middle ſpace of the firſt conuolutions, as it were out of a large baſis, and being by degrees extenuated, endeth in a ſharpe point; but it aſcendeth not ſo high as that it toucheth the circumference of the bone wherinto the firſt gyrations doe determine. *Euſtachius.*

This wonderfull prouidence of our Creator, *Empedocles* as *Galen* witneſſeth in his booke *de hiſtoria Philoſophica*, did firſt intimate, when hee ſaith that the ſenſe of hearing is made by the impulſion of the ayre, or of a ſpirit which ſtriketh & beateth the part like a Snailes ſhell, ſuſpended within the eare like a bell. And with him agreeth *Ariſtotle* in the eleuenth chapter of his firſt booke *de hiſtoria Animalium*, where he ſaith, that the inward eare which is like the contortions of a Snayles ſhell, endeth in a bone which is like the outward eare. *Empedocles.* *Ariſtotle.*

This third cauity as alſo the ſecond and the burroughs thereof, are inueſted with a ſoft and thin membrane, after the ſame manner that the ſockets of the teeth are. *Veſalius* ſaith it is a part of the nerue of the fifth coniugation, and that it doth inueſt but ſome parts onely of the cauity, not all throughout. Into this cauity as well as into the former, do run three or foure holes ſo ſmall that a haire will ſcarſe paſſe through them, iſſuing out of that canale through which we ſayd the auditory nerue doth paſſe; through which holes certain nerues of the fift coniugation, or at leaſt their faculty is communicated to the foreſayde membrane. So differeth *Bauhine* from *Veſalius*. The membrane inueſting this cauitie. *Veſalius.*

And although it is generally beleeued that the ſenſe of hearing is eſpecially made in the firſt cauity, yet it cannot be denyed but that it is alſo made in the others; ſeeing into them as is ſayd, there are ſurcles of nerues deriued, and in them alſo Animall ſpirits and Inbred ayre is contained. Notwithſtanding the two hindmoſt cauities were rather made to hinder an Eccho or reflexion of the ſound to the firſt cauity. And whereas theſe cauities haue holes of diuers magnitude, length and figure, it is reaſonable to thinke that they were ſo framed for the difference of ſounds. For a baſe ſound and a great quantity of ayre require a large hole. *Bauhine.* The vſe of theſe cauities. Why perforations are of diuers kinds.

The length prohibiteth the Eccho and the reflection of the ſound, wherefore the greater ſound required longer canales, and the leſſer ſhorter, that the ſound in them might as it were, be appeaſed, and an Eccho prohibited. The varietie of the figure maketh much either for the naturall delation or tranſmition of the ſound and the ayre, which runneth for the moſt part through circled meanders; or that the ſound in them might reſt: now we may eaſily imagine that a ſound will ſooner ceaſſe or bee appeaſed when it runs through many turnings or gyrations then it would doe if it were conueyed by a ſtreight line.

But the vſe of this third cauitie *Coiter* elegantly ſheweth and confirmeth by an inſtance in a circled inſtrument, put caſe it bee a Sackebut. For if a man lay his eares to the holes of ſuch an inſtrument, hee ſhall here a wonderfull whiſtling and hiſsing noyſe and murmure: where if a man blow into it with his mouth it will ſound like a Trumpet. And thus much concerning the ſtony bone and the cauities thereof: now we proceed. The vſe of the 3. cauitie after *Coiter.*

CHAP. XXIII. *Of the Nerue which ariueth at the Eares.*

AT length we are come to the Auditory Nerue which maketh that coniugation which is commonly called the fift, [Tab. 21. lib. 7. fig. 1. 2. a. Tab. 15. lib. 7 fig. 20. M.] It iſſueth out of the tranuerſe proceſſe of the *Cerebellum*, and is a thicke and large nerue; therefore neereſt of all to the After-braine becauſe it was to conuey a great quantity of Animall ſpirits. It inſinuateth it ſelfe into the firſt hole of the ſtony bone, which a large perforation and made of purpoſe within the ſcull for the tranſmiſsion of this nerue, which it hideth all the way it runneth forward, till in the middle almoſt of the ſtony proceſſe it is diuided into two vnequall parts: the one large & ample, the other ſmall but harder; harder I ſay then the other, not through out the length of it, but onely in that part which is longer then the former. For, that wee may ſay ſo much by the way, the ſoftnes or hardnes of a nerue dependeth vpon 3. things. Firſt, vpon the originall, ſo thoſe nerues that ariſe out of the Braine it ſelfe are the ſofter, thoſe that ariſe out of the After-braine or out of the ſpinal marrow are the harder. Secondly, vpon their diſtance, as they are farther from their originall, or neerer vnto it. Where it ariſeth. How many waies a nerue becomes hard and ſoft.

So the Opticke nerues are the ſofteſt of the whole body, becauſe they are neereſt to their originall; the nerues of the hands and feete the hardeſt, becauſe they are fartheſt off. Or, thirdly, it hangeth vpon their contaction: for frō their contactions with hard bodies as bones & griſtles, or with ſoft as fat and veſſels, they become harder and ſofter as *Placentinus* hath obſerued, but this by the way. This ſlender production of the nerue through the vpper hole of the forementioned paſſage entereth into that ſecret bony canale which we called the *Watercourſe*, and ſo creepeth toward the forepart of the head. Afterward it is reflected and entereth into the firſt cauitie, and falling downeward and backeward, it iſſueth out of the bone at the roote of the lap of the eare, and is ſubdiuided into three eſpeciall branches. The larger and vpper runnes out into the foreſide and the backeſide of the roote of the outward eare. The lower deriued through the iaw, is diſtributed into the *Maſſeter* muſcle and the firſt muſcle that mooueth the cheeks. The third which is the middlemoſt is very ſmall and Capillary, and is diſſiminated into the glandulous and membranous parts about the roote of the eare. There are alſo other threedy ſurcles which are ſpent into the muſcles of the larynx or throtle, and of the bone *Hyois*. And this is the cauſe of the conſent betweene the eares, the tong and the larynx. Hence alſo it is that when the auditory nerue is originally and in the firſt conformation obſtructed, thoſe that are borne deafe are alſo dumbe; and thus much of the leſſer part of the nerue.

3 branches.

Small threds of the auditory nerue.

Why thoſe that are born deafe are alſo dumbe.

The thicker part of the nerue which is ſoft, and is properly the *Nerue of hearing*, becauſe it of it ſelfe is the cauſe of this ſenſe, is led through the hole of the foreſayd paſſage and runneth out into the dens or caues of the ſtony proceſſe: yet the larger branches doe determine in the firſt cauitie as being the largeſt and of moſt vſe, where they are dilated like a membrane and make the chiefe inſtrument of hearing. Wherefore the receiued opinion is, that in this cauity the ſenſe of hearing is eſpecially adminiſtred, becauſe into it the Animall ſpirit entreth through the nerue, & is there mixed with the Inbred ayre. Out of this cauity through ſmall proforations of the foreſaid cauitie run certaine ſmall threds into the other two cauities, which are communicated to the membrane wherewith they are compaſſed.

The very nerue of hearing.

The vſe of this nerue is (according to *Galen* in the ſixth chapter of his eight booke *de vſu partium & Auerrhoes* 2. *Collect.*) to be the Organ of hearing, and to receiue the ſenſible obiect that commeth from without, and to leade the images of the ſounds vnto the braine as vnto their competent Iudge and Cenſor ſaith *Laurentius*.

The vſe of it.

But from a branch of the fourth coniugation of the braine, there departeth a very ſmall ſurcle, which with a winding paſſage entereth into the cauity of the Eare neere the bony canale which goeth to the palate, then it cleaueth obliquely to the Tympane, and after to the Hammer aboue the inſertion of the muſcle, and proceeding on perforateth the ſtony bone in the backeſide of the hole of the hearing: then, a little reflected, it creepeth downeward till it meete and ioyne it ſelfe with a ſmaller and harder branch of the fift coniugation. This *Euſtachius* calleth a Nerue, others call it the chord or thred which, ſay they, runneth through the middeſt of the membrane of the Tympane; but whence it ariſeth and whither it would, or whether it be a nerue or an artery, they freely confeſſe that they are ignorant.

The Chord.

Euſtachius.

CHAP. XXIV. *Of the Implanted or Inbred Ayre.*

Galen in his ſeuenth booke *de Placitis*, ſpeaking of the inſtruments of the ſenſes determineth; that the inſtrument of ſight is lucid or bright, that of the hearing aereall, that of the Smell vaporous, that of the Taſt moiſt, and that of the Touch earthy. Wherefore when wee ſay that the inſtrument of the hearing is ayry, or like vnto ayre, we vnderſtand that it is a part of mans body (taking the word Part in a large ſignification) which imitateth the nature and condition of the ayre.

The obiects of all the ſenſes.

Plato.

This ayre of which *Plato* among the Philoſophers made firſt mention, is ſeated in the eares from the firſt originall of our generation in the wombe of our mothers. I meane as ſoone as there were emptie cauities hollowed in the bones, all which are filled with this ayre. And therefore the ancient Philoſophers and Phyſitians, yea *Ariſtotle* himſelfe in the eight chapter of his ſecond booke *de Anima*, and the 83 text called it συμφυὴς, or *Inbred*. Others call it *Congenit*, *implanted*, *complanted* and *inædificated*. It is made of the ayry part of the ſeede and that very pure, to which the pureſt ayry part of the mothers blood applyeth it ſelfe, as to a body moſt like vnto it ſelfe, ſaith *Archangelus*.

How this aire is generated.

The names of it.

This

This aire is conteined in the cauities of the ears; which may be proued, becauſe all the dens and cauities excepting the firſt in which are the ſmall bones the Muſcle & the Chord are empty, ſeeing therfore there is in Nature no vacuity, it is neceſſary that theſe empty cauities muſt be full of aire. Where conteined.

This aire is thin, pure, without any ſound at all, immoouable, plentifull & ſeparated from the externall aire. *Thin & pure* that it might more readily and more perfectlie admit any externall ſound, for through a craſſe and cloudy aire the ſound is not ſo freelie caried, but heard with more difficulty; whence it is that a mans voice in winter is baſer then in Summer, becauſe as ſaith the Philoſopher in the 17. Probleme of the 11. Section both the inward and the outward aire is thicker in winter then in ſummer, now beeing thicker it is mooued more ſlowly. The nature of this aire. Pure. *Ariſt. Problem.*

This aire is *without any ſound*, and therefore in the night we may hear better becauſe there is no noiſe ſtirring, as *Ariſtotle* teacheth in the 33. probleme of the 11. ſection. Ad hereto that which he in the ſame place addeth, that in the day time the aire is denſe, becauſe it is filled with light and the beames of the Sunne, but in the night more rare, becauſe the fire and the beames are departed thereout. without ſound *Ariſt. Problem.*

Wherefore the outward aire which is altred by ſounds, and like a waue of the Sea boundeth to the eares is not admitted into the inward eare, neyther dooth it touch the implanted aire; for if it had, the ſenſe of hearing would haue bene imperfect and the Inſtrument would ſoone haue bene vitiated, which *Ariſtotle* proueth by an inſtace in thoſe that yawne, in the 29 probleme of the 11. ſection, and in his fift booke *de generatione animalium* and the ſecond chapter. For when we yawne we cannot heare ſo diſtinctlie, becauſe much of the aire we breath forth getteth into the ears, inſomuch that we may ſenſibly perceyue the motion thereof; for when the internall aire reſiſteth the occurſation of the outward there ariſeth a noyſe in the eares, which noiſe as alſo the circumaction or diſturbance of the ſpirit hindreth our hearing whilſt it be agayne appeaſed. *Ariſtotles* inſtance. Why we cannot heat well when wee yawne.

Againe, it was neceſſary that this implanted aire ſhould be *immoouable* by it ſelfe or of it owne nature, that it might exactly receiue al the differences of ſounds, of *motions* ſaith *Ariſtotle* in the eight chapter of his ſecond booke *De Anima*. Others ſaie, it is immooueable becauſe it is not mooued by any other but remaineth alwayes the ſame in the eares. Others becauſe it hath no naturall ſound but is fit to receiue all differences of ſounds ſaith *Laurentius*. But that the inward aire ought to be quiet and immoouable may bee prooued by the indiſpoſition we haue in our hearing when we are troubled with hiſsing or ſinging noyſes in our heads. Yet is this aire mooueable not of it owne accord, but becauſe it is mooued with the leaſt impulſion of the outward aire and is ſtirred with locall motion; for whē the outward aire mooueth the membrane of the Drum, the internall aire is alſo mooued, that it may receiue a forme like to the forme of the ſound which is made. Immooueable How it is mooueable.

It is *Plentifull*, for plenty is required for the full reception of the ſound; ſome ſay that it may be able to receiue many ſounds offered vnto it at the ſame time, but *Placentinus* ſaith it doth not receiue many ſounds becauſe of the multiplicity of the partes thereof, becauſe each ſound is receiued by euery little particle thereof. Plentifull.

It is *ſeparated from the externall aire* by the interpoſition of the membrane of the Tympane leaſt the inſtrument of hearing ſhould be offended. For if the externall ayre ſhoulde haue gotten into the inward aire; if it had bene either too cold or too hot it would haue violated the auditory Nerue, and by continuity the After-braine alſo and the Braine it ſelfe. Moreouer, if the externall aire ſhould haue bene imediately ioyned and commixed with the internall, ſeeing the externall is in perpetuall motion, thicke, impure, oftentimes alſo ſmoakie and full of ſmall creatures, it could not haue bene auoyded but that the Hearing would thereby haue bene impaired if not periſhed; for the inbred aire alſo woulde haue become thicke, ſmoaky, and alſo filled with thoſe ſmall Animals. It would alſo haue ſomtimes happened in violent motions of the outward aire, that the in-bred aire and with it the Animal ſpirit muſt haue bene ſhouldred out of their proper place and the hole of hearing quite rammed vp. Furthermore, this benefite wee haue by the membrane that ſeparateth the externall from the implanted aire, that if a man be vnder water the water cannot pierce into his head or take away his ſenſe of hearing, as thoſe Diuers find by experience, who for Fiſh or Pearle or any ſuch like occaſion do vſe to Diue into the bottome of the water. Separated from the outward aire.

Neyther is this implanted aire of the ſame nature that the outward aire is of, but hath only

The Nature of the implanted Aire.

onely a similitude therewith, which we may gather out of these words of *Galen*. *Neyther is euery Instrument of sense changed, altered or affected by euery sensible obiect: but that which is bright and lightsome is altred by colours, that which is aiery by sounds, that which is vaporous by odours, and in a word that which is like is familiar to his like.*

Like the Animall Spirite.

Wherefore we esteeme the nature of this aire to bee the same with the Animal spirite which also is aiery, and that there is the same maner of the conseruation and refection of the one and of the other. For this implanted aire is succesiuely generated and againe dissipated, as the Animall spirit is continually spent in the Animall actions, and againe euery day regenerated. In like manner this aire that is bred in the eare is (at least a parte of it) continually dissipated and generated againe; for if it should altogether bee exhausted or spent we should vtterly loose our hearing. Now it is strengthned and hath his refection from the aire which we draw in by our nosethrils and through our mouthes, especially by that which entreth at the mouth, for there is a patent and open passage thorough the Canale which we haue before spoken of out of the mouth into the Eares, by which passage also we saide before that the eares were purged.

How nourished and restored.

Simplicius. *Coyter.*

Simplicius the Philosopher hath deliuered, not that this aire is like the animal spirit, but that it is a thing Animated or hauing a life of it owne, wherby it subsisteth. *Coiter* calleth it a part of the Soul, *Archangelus* conceiueth that it is norished by blood, whose opinion we will heere set downe, that those that list may iudge of it.

A passage out of *Archangelus.*

The aiery bodie (saith he) is nourished by blood brought by the Veines, and that *per Diadosin* that is by Transumption, as the Cristalline humour of the eye is nourished by the glassie humour, by this *Diadosis* or transumption. For there redoundeth out of the glassy humor as much as is sufficient for the nourishment of the Cristalline, like as the glassy humor transumeth from the Membrane called *Aranea* or the *Cobweb* an Aliment accommodated and proportionable to it selfe. And this commeth to passe after this manner. In the Coate called *Aranea* or the *Cobweb* there are Veines by whose bloud it is nourished. After the Cobweb is satisfied, that which redoundeth or is superfluous is transumed by the Glassy humor: when the Glassy humour is satisfied with norishment, that which remaineth is transumed by the Cristalline humor as a fit nourishment for it, so that the Cristalline is nourished by an Aliment, prepared by the vitrious humor, & the vitrious or glassy humor is nourished by an aliment prepared by the Cobweb, to wit, either of the others superfluities or leauings.

What *Diadosis* or transumption is.

How the Aire is nourished.

The same happeneth in the aiery iustruments of Hearing. For the Membrane that inuesteth it receiueth Veines and is nourished with their blood: that which aboundeth beside the nourishment of the Membrane, being now far altred from the nature of blood is attracted and transumed by that aierie body into his proper nourishment. But that this instrument of Hearing might haue not onelie venall nourishment but Arteriall life also, and with it al the parts that are subordinate and ministering to it; there are certain Arteries which are deriued into the structure of the organ of Hearing. Thus far *Archan.*

The vse of this Aire.

Concerning the vse of this implanted aire our Authors are full of diuersity. *Aristotle* in the 10. chapter of his second Booke *De partibus Animalium* and in the second chapter of his fift Booke *De Generatione Animalium* cals it *audiendi sensorium*, the verie Sense of Hearing it selfe. And truly the Ancients haue all deliuered that it is the chiefe and principall Organ of Hearing, and from hence it was that *Aristotle* saide that the Nature of Hearing was aiery.

Diuers opinions.

Aristotle

Mundinus.

Mundinus saith, there is an audible spirit in the cauity of the Stony-bone which is the instrument of Hearing.

Carpus.

Carpus thus. The implanted aire receyueth the species or formes which are brought to the Sense of Hearing.

Varolius. *Coiter.* *Archangelus.*

Varolius. The included aiery spirit is the proper instrument of Hearing.

Coiter. This aire is the first and principall organ of Hearing, yea a part of the Soule.

Archangelus. It is the most principall instrument of Hearing, which the Faculty vseth in the perception of sounds and voices, and in iudging of them.

Aquapendens.

Aquapendens. The office of this aire is to receiue outward and externall sounds, & so it is the principall author of Hearing.

Placentinus.

Placentinus. It is the matter which receyueth the sound, the *Medium* where-through it is transported. For after it hath receyued a sound it doth not conceyue it or iudge of it as being a thing inanimated, now no action of the soul can be performd by that which is not animated.

Laurentius

Laurentius. This Aire is exceeding neceſſary to the Senſe of Hearing, without which I can ſcarcely conceiue how we ſhould heare at all; but that it is the principal organ of Hearing I could neuer bee perſwaded, eſpecially becauſe it is not Animated, but rather I beleeue it to be an internall *Medium*. *Laurentius.*

Finally, our Authour *Bauhine* ſetteth downe the vſe of it in theſe tearmes. *Bauhine.*

This Aire the faculty of Hearing vſeth as an internal *Mediũ* for the ſuſception and tranſvection or tranſportation of Soundes and Voyces to the Auditorie nerue, by it to bee diſcerned, like as in all the inſtruments of the other Senſes there is required a double *Medium*, the one outward the other inward. Inward, as in the Sight the watery humour, in the Taſte the ſpittle, in the Smell the ſpongie bones, in the Touch the skinne is the internall *Medium*, (although I know *Laurentius* would haue it the Cuticle) in which the formes or *Ideas* of things are ſeparated from the things themſelues, and ſo naked are tranſported vnto the firſt *Senſator*. An inward & an outward *Medium.*

In like manner the implanted ayre is gathered in the inward eare, to receiue the abſtracted formes of the Sounds, and to tranſport them or conuey them vnto the Senſe.

Againe, as in all the inſtruments of the Sences the internall *Medium* is diſtinct, and a differing thing from the principall Organ to which the action particularly belongeth; as in the Organ of Sight the waterie humor is thought to be the internall *Medium*, but the chryſtaline the principall part receiuing the repreſentations, but not iudging of them: ſo in the Hearing the internall *Medium* is this implanted Aire; but the principall part is the Auditorie nerue, which yet doth not iudge of the *Idea*, but conducteth it to the braine, that is to the firſt *Senſator*. That it is not the chiefe organ of hearing.

CHAP. XXV. *Of the manner of Hearing and of the Nature of Soundes.*

COnſidering that to intreate of the manner of Hearing belongeth rather to a Phyloſopher then to Anatomiſts, wee will be but briefe herein, yet ſomthing we thinke good to ſay becauſe the ſtructure of the eare was for the moſt part vnknowne to the Ancients.

The Eare is the inſtrument of Hearing, and the action of the Eare is the Senſe of Hearing; vnto this Senſe there are three thinges required: an Obiect, a *Medium* and an Inſtrument. The Obiect is that which is audible, that is, all Sounds. A Sound is a quality yſſuing out of the Aire (*Coiter* addeth, or the Water) beaten by ſudden and forcible colliſion or concurrence of hard and ſolid bodies, and thoſe ſmooth, concauous and large. This definition we will labot to explaine in this following diſcourſe. The *Medium* is eyther Externall or Internall. The Externall *Medium* according to *Ariſtotle* is Ayre or Water, but in water the Sound is but dull, as a man may perceiue when his head is vnder water: yet they ſay that Fiſhes can heare in the water very well, as they can aſſure vs that vſe in the night time to fiſh for Mullets. And although the water going into the water doe make a Sound; yet this Sound is made *in* the Aire and by the interpoſition therof, though it be made *by* the water. Three things required to Senſation. Obiect, Definition of a Sound. *Medium.*

The Internall *Medium* is the implanted Ayre concluded within the dennes or cauities of the Eares. The Inſtrument although we may ſay it is the whole inward eare furniſhed with his cauities and other particles aboue expreſſed, and although that generally the Philoſophers and Phyſitians doe determine that the inbred Ayre is the eſpeciall and proper Organ of Hearing; becauſe as in the Eie the Chryſtaline receiueth the Obiect, that is, the Light: ſo this in-bred ayre receiueth the Sound. Yet we are of opinion that not this ayre but the auditorie nerue is the principall inſtrument. For wee thinke with *Galen*, that not onely the alteration or Reception which is made by the in-bred ayre is the Senſe of Hearing, but alſo the dignotion or iudgement of that alteration. VVherefore Soundes and Voyces are transferred by this ayre to the Auditory nerue as vnto the ſubſtance that is apprehenſiue, and from thence to the common Senſe where they are exquiſitly iudged off. For if they muſt bee knowne and perceiued, then muſt they touch ſome ſubſtance indued with Senſe, becauſe all action is by contaction. Now the Senſatiue faculty is not tranſported out of the bodie, and therefore it was neceſſary that the Sound ſhould apply it ſelfe to the Eare. 3. Inſtrument.

The Sound is generated of hard bodies mutually ſtriking one another, as of the Efficient cauſe, (for ſoft bodies doe eaſily yeeld, not reſiſting the force that is offered vnto them) and How ſound is made.

and is receiued in the ayre as in his matter: this Aire accompanieth the Sound, and carryeth it as it were on his wings; for as the ayre is mooued so also is the Sound carried as wee may perceiue by a ring of Belles farre off from vs: for when the winde bloweth towards vs we shall heare them very lowd: again when the ayre is whiffed another way, the sound also of the bels wil be taken from vs. So also when two hard bodyes are smitten the one against the other, we see the purcussion before we heare the sound, for we do not heare the sound before the ayre that was moued do bring the sound with it to our eares, neither is that motion made in a moment but in time, and is carryed swifter or slower as the percussion of the resisting bodyes was more or lesse vehement and quicke, (for this the Phylosopher requireth in sounds) and consequently the repercussion or repulse of the ayre. So wee see in a Drumme if the skin or Vellam be moist and laxe, either they will not sound at all, or they make but a dull noyse.

How the soūd attaineth to the Eare. A fit comparison.

The Aer being affected with the quality of the sound driueth & altereth that ayre that is next it, and so by succession till the alterations come to the Ayre that is next to the outward Eare: euen as when a stone is cast into the water it stirreth vp circles which driue one the other till the water moueagainst the brinke, or if the water bee broade doe of it owne accord determine. In like manner by the percussion of the Ayre there are generated certaine circles which mooue one another till by succession they come to the Organ of hearing: which continuation of the Ayre thus beaten *Auicen* and the antient Anatomists call *vndam vocalem*, the vocall waue.

Vnda vocalis.

But if the stone be great and violently throwne into the water, so that it driueth the circles vehemently to the brimme of the pond, then will those circles be repelled againe and so runne doubled and hudling to the first circles. In like manner if we hallow or speake alowde against any arched place, or against a wood or a mountaine, the voyce will bee doubled and an eccho will answer vs.

What Ayre is fittest to receiue a sound

But all ayre doth not alike receiue a sound. For a pure thin and cleere ayre, which is vehemently and suddainly strucken by two hard bodyes whose superficies is broad, will sooner receiue the sound, and represent it more smartly then if the Ayre or the bodyes bee not so prepared. A Needle strucke against a Needle will not make a sound though they bee hard bodyes, because their superficies is narrow and not broad, and so in the rest. But aboue all that Ayre which is contained in a concauous or hollow place, doth best receiue the species of soundes; because in the reflexion there are many percussions besides the first; for the reuerberation of the Ayre maketh much for the increasing of the sound, which we may see in dens, caues, woods, hollow mountaines, wels, and such like; which will not only returne againe the sounds that they receiue, but sometimes also the very articulated words. And thus much concerning the nature and generation of sounds, which is a meere Phylosophicall disquisition, and therefore we passe it ouer more briefly. Now let vs come to shew how the outward Ayre that is beaten, is communicated with the implanted Ayre and the internall parts.

Diuers opinions of the manner of hearing.

But before we descend to this it shall not be amisse to let you take a view of the diuers opinions as well of the Antients as of the Moderne writers, concerning the manner how hearing is made, for vpon that very point we now are.

1. *Empedocles.*

The first is that of *Empedocles*, who thought that this sense of hearing is made because the Ayre offereth a kind of violence to the inward part of the Eare, for because the inward Eare is intorted like a winkle-shell, and hangeth as a bell in thee steeple of the body, it easily perceiueth all appulsions of the Ayre.

2. *Alcmeon.*

The second is that of *Alcmeon*, who thought that wee therefore heare because our Eares are within empty, for all emptie things doe resound if the sound get into them.

3. *Diogenes.*

The third is that of *Diogenes*, who saith, that in the head there is an Ayre which is smitten by the voyce and so mooued: against whom *Hippocrates* writeth in his booke *de carnibus*, where he saith, that there are some Authours of Naturall Phylosophy, who affirme that the Braine yeeldeth a sound, which cannot be. For the braine it selfe is moist, now no moist thing will resound, but that onely which is drie.

4. *Hippocrates.*

The fourth is the opinion of *Hippocrates* in his booke *de locis in homine*. First of all saith he, the eare is perforated, and in that part we heare, yet the emptie places about the eares doe heare nothing but a confused noyse, but that which entereth through the membranes into the braine, that is distinctly heard; where there is a perforation through the membrane

membrane which inuesteth the Braine. And in his booke *de carnibus*, we heare because the holes of our Eares reach vnto the dry and stony bone to which is added a canale or fistulous cauity, against which hard bone the sounds do beate, and the hollow bone because of his hardnesse yeelds a reasonance. Now in the hole of Hearing neere that hard bone, there is a thin Filme like a Cobweb the driest of all the Membranes of the body: but that which is the driest is fittest to conceiue or receiue a sound as may be prooued by manie arguments. When this Membrane therefore yeeldes the greatest resonance then wee heare best.

The fift is *Platoes* opinion. The aire that is implanted in the eare is beaten, that pulsation is transmitted into the principall seate of the soule and so we heare. 5. *Plato.*

The sixt is *Aristotles*. We heare (saith he) when the aire is mooued by two solid bodies, that which is beaten hath a plaine superficies that from thence the aire might result; the concussion of these two bodyes must be vehement, that the aire between them may not diffuse it selfe, but bee apprehended and smitten before his dissipation, for so onely the sound resulteth and filleth the aire by continuation euen to the eare. Now in the organ of Hearing there is a certaine implanted Aire. Hence it commeth that when the externall aire is mooued the internall receyueth therefrom a motion and agitation (which otherwise of it selfe is immoouable) so as it exactly perceyueth al the differences of the motion of the externall aire. Thus is the Hearing begunne and perfected in the Ayre. 6. *Aristotle.*

Seauenthly, *Galen* in the sixt chapter of his eight Booke *De vsu partium*. It was necessarie (saith he) that from the Braine a certaine surcle should be propagated downwarde to the eares, which might receiue the sensible obiect comming from without, whether it were a voice or a sound made by the percussion of the aire; for the motion that is caused by such a percussion diffuseth it selfe like a storme of winde or raine, or like a waue of the Sea till it ascend vnto the Braine. 7. *Galen.*

Thus far the Ancients, who most of them, if not all, were ignorant or at least much to seeke in the exact Anatomy of the Eye. Among the later writers *Vesalius* and his adherents haue it thus: 8. *Vesalius.*

A Nerue of the fift coniugation proceedeth through a torted and writhen passage, and extendeth it selfe into a Membrane where-with the hoale of the eare is stopped, which Membrane being thin, dry, and well stretched & beaten by the outward aire maketh a sound, being assisted by the hardnes of the bone and his turning gyrations much like the shell of a Snaile or Periwinkle.

Columbus. So also we heare by the help of a Nerue of the fift coniugation, which at the middle of the Labyrinth becommeth thicker, but yet maketh not the Membrane.

Messa saith, that the sound is made by the motion of the small bones, and thence we heare. 9. *Messa.*

Volcherus Coiter. The outwarde Aire affected with the quality of the founde runneth vpon the Membrane or Head of the Drumme, which when it is beaten mooueth the small bones that are tyed to it. The bones strike the Nerue that runnes ouerthwart the Membrane. The same Nerue makes a repercussion vpon the Membrane, whence it is that the ayre included receyueth the alteration and the sound. The Sounds without any disturbance are carried through the contorted Meanders of the Eares to the Auditory Nerue, which receyueth the Image of the noise, and presenteth it to the principall Sensator. 10. *Coiter*

Laurentius hath almost the very same in substance. The outward aer (sayth he) being striken by hard and solid bodies and affected with the quality of the sound, altreth the aire that is next vnto it, till by a continuation it come to the eares, where it first encountreth with the Membrane: the Membrane being strucken mooueth the three little bones and transmitteth in a moment the liuely Charracter of the sound, which Character is receyued by the implanted aire, and through the windows it sendeth it through these crooked and winding Labyrinths into the Snaile shel, from whence it arriueth at the auditory Nerue, and from thence is conueyghed to the common Sense as vnto an equal iudge or Censor. 11. *Laurentius.*

Archangelus hath it on this manner as neere as I can vnderstande him. The thing that maketh the sound sealeth or stampeth in the ayre the species or forme of the sound, and withall driueth it on vnto the Instrument of hearing which is also aiery that it might bet- 11. *Archangelus*

ter

ter receiue thoſe ſpecies, and muſt likewiſe be mooued; wherefore the hole of the Eare ſtanding alwayes open (and in his inſide ſupporting the ſtretched membrane of the Tympane, behinde which the aiery inſtrument of Hearing is concluded or ſhut vp, and to which the Anuile cleaueth) when the outwarde aire attaineth to that membrane the Hammer beateth vppon the Anuile, and ſo it commeth to paſſe neceſſarily that the Inſtrument of Hearing (by which he vnderſtandeth the implanted Ayre) it mooued vvith the ſame motion that the outward Aire is moued; whence it is that altogether the ſame ſpecies or ſimilitude of ſound mooueth the Faculty of hearing, which is brought thither by the outward aire. Nowe the Nerues of Hearing do determine into the ſame place where this aerie inſtrument of Hearing is concluded, and a membrane made of the amplification of theſe Nerues encompaſſeth that aery bodie, as the Opticke Nerues doe ariue at the Criſtalline humour. And as the Opticke Nerues do conuay vpon the wings as it were of the Animall ſpirit from the place of the Common ſenſe the *Viſiue* Facultie to the Criſtalline humor: ſo theſe Nerues from the ſame Common ſenſe doe tranſport the Faculty of Hearing to the principal organ of Hearing, that there might be a perception made of audible things. And ſo the Hearing when it hath apprehended the ſounde of an audible thing carrieth it to the Soule, and then the Reaſon or the intellectuall or ſenſatiue Soule comprehendeth and taketh knowledge of that which maketh the ſound to be a Bell or a Drum, or any other thing.

13. *Bauhine.* Finally, *Bauhine* my Authour (I call him ſo often my authour to ſtoppe their mouths who would think that I ſhould arragate too much to my ſelfe if I ſhoulde not acknowledge him from whom I haue taken moſt of this Hiſtory) expreſſeth it on this manner. The outward Aire is an external *Medium* which being driuen and moued by the mutual percuſsion of two hard bodies and affected with the qualitie of the ſound, carryeth the ſound which reſulteth from that percuſsion vnto the Eare. The ſound paſſeth through the hole of hearing which is alwayes open vnto the Membrane of the Tympane which it mooueth.

That Membrane being mooued, the implanted or in-bred aire is alſo moued and receiueth the ſound, or at leaſt his Caracter or impreſsion, and tranſporteth it out of the firſt cauity of the ſtony-bone thorough the hole of the Stirrop and the *Ouall window* to the other two cauities which we called the *Labyrinth* and the *Snayle-ſhel*. From thence it is conueighed to the auditorie Nerue and to the originall thereof, that is the Afterbrain and ſo to the common ſenſe as vnto a Iudge that is able to determine of the differences of ſounds.

And becauſe the Auditory Nerues are ioyned in the *Bridge* of the After-brain from whence they proceed, therefore all ſounds are apprehended in one comprehenſion, not in two though there be two eares, that is, two organes of Hearing. But leaſt the Membrane before mentioned ſhould be driuen too much inward by the violence of the outward aire when it is violently beaten, Nature prouided three ſmall bones and Muſcles as we haue ſhewed before to preuent that inconuenience.

The vſe of the Senſe of Hearing according to *Ariſtotle* in his Booke *De ſenſu & ſenſili* is to acquire or get knowledge and wiſedome. For ſpeech being an audible thing is the verie *Cauſe* of Learning. Againe by the Hearing things are ſignifyed to our ſelues, as by our voice and tongues we are able to ſignify any thing to another, as *Ariſtotle* hath well obſerued in the end of his third booke *De Anima*.

The vſe of the Hearing *Ariſtotle.*

A deprecatiõ. And ſo much ſhall haue beene ſufficient to haue ſpoken concerning the Senſe of Hearing, wherein I finde that I haue great cauſe to entreate my Reader fauourablie to reade ouer this Diſcourſe, and to pardon me if in ſome things I haue not ſo fully ſatisfied him; for there are ſome paſſages in my Author, wherein I haue bene intangled, partly by the difficultie of the matter, partly by the fault of the Printer, for in ſuch a caſe as this the leaſt error may prooue a ſufficient *remora* or obſtacle to interrupt the courſe of a Diſcourſe, but as neere as I could I haue followed their words, at leaſt their meaning, if they vnderſtood themſelues, as of ſome of them I make much doubt.

CHAP

CHAP. XXVI. *Of the Nose which is the instrument of Smelling.*

HAuing absolued the Historie of those many particles which belong vnto the sense of hearing we will now come to the third outward sense which is the Smelling. As therefore wee sayd in the Eare that there was an outward Eare and an inward Eare, so must we also diuide the Nose into an outward and inward. The outward Nose carryeth with it, sayth *Laurentius*, a kind of beauty, yea of maiestie; and the *Egyptians* in their *Hyeroglyphicks* signified a wise and prudent man by a nose: and *Festus* calleth such wise men *Nasutos*, as if they were able to sent or smell the politicke stratagems of other men. Besides man, onely those creatures haue this outward Nose that haue foure feete and bring forth liuing ones, as for birds and serpents (saith *Aristotle* in the 16. chapter of of his second booke *de partibus Animalium*) & and those foure footed beasts that lay egges, they haue onely φορὰς τῶν μυκτυρίων, holes of the Nose, which are not so compassed or formed that you may call them Noses; vnlesse it bee because they breathe and smell by them. As for those Creatures which doe not breathe, they haue no Nose or holes at all, but other instruments of this sence, some smell by their gills, some by their *fistula* or pipe or trunke, some otherwayes, as some of those wee call *Insecta*.

The outward vse.

Nasuti.

Aristotle.

This outward Nose is called ῥὶς by *Aristotle* in the 11. chapter of his first booke *de historia Animalium*, and in the 16. booke *de partibus Animalium*, as also by *Galen* in his booke *de olfactus instrumento*. The word seemeth to be deriued from ῥέω, because through the Nose the excrement and superfluities of the head doe fall away. Others call it μυκτὴρ, because of the mucous matter or phlegmaticke excrement which distilleth through it. If we should describe the Nose, we must say that it is a protuberating or strutting part of the face, making a way for the Ayre, for by it we receiue it in and auoyde it out againe: some say it is a defence for the instruments of smelling, when as indeed they are not contained in the Nose, but remaine within the skull. Yet we will not deny but that it is an assistant ro them, for if the Nose were away we should not smell without all question.

The names.

The reason of the figure.

It is scituated betwixt the Eyes, for the part whereby wee breathe ought to bee in the middest and before. Nature therefore placed it in the middest betweene three other senses, the Sight, the Hearing and the Tast, and in a straight line that the respiration might not be interrupted but passe freely to and fro.

And scituatiõ.

Moreouer it is placed saith *Cicero* in his second book *de natura Deorum*, aboue; because Odours flie vpward and therefore from aboue are more commodiously receiued. Add hereto it that standeth vs in good steed to smell our meats & drinks being so neere the mouth, which instinct Nature hath giuen also to bruite beasts, as we may see especially in Apes who first smell to a thing before they will eate it. In a man the chiefe vse of the position of the Nose is for beauty and elegancie.

The Basis of the Nose aboue is broade and groweth into a blunt end downeward, or rather, saith *Laurentius*, it beginneth with a sharpe point from the inward Angles or corners of the eyes, and endeth at the beginning of the lips.

It is diuided into an vpper part which is immoueable and bony, and a lower, which is moueable and gristly. The vpper part of the Nose called *Dorsum* or the barke is called in Greeke ῥινὸς ῥάχις the spine or ridge of the Nose. The lower part where it inlargeth it selfe, into the Nosthrils is called ἀκροκῴνιον by *Ruffus* and *Pollux*: the foote of the Nose, and the vtmost roundnesse σφαῖριον the globe of the Nose or the tip as wee commonly speake,

The diuision of the nose.

Within it is diuided into two cauities by a hedge or partition which they call ῥινῖνες. *nares* the Nosthrils, because in them the odors or odoriferous spirits or the Ayre doe *innare* or swimme continually; others call them μυκτῆρης of the mucous matter that issueth from them, others τῶν ῥινῶν πόροι, the holes of the Nose as *Galen* hath it in his booke *de instrumento Olfactus*.

And the names of the parts.

The vse of the diuision is, that the action of the smelling might be more perfect, for in al the parts of sense (excepting the Touch) the sense is bypartite, because of the two sides of the body, the right and the left.

The vse of the diuision.

In like manner saith the Phylosopher in the tenth chapter of his second booke *de partibus Anim.* the power of the Nosthrils is double or bipartite, but if they had bin disseuered or set aside as the eares they could not haue performed their office; because we smell euen

breathing, as also doe all other creatures which haue nostrils. Againe, by reason of this diuision one nosethrill remaines open when the other is obstructed, that thorough it wee might haue the benifit of Inspiration and Expiration, and when both of them are obstructed the mouth may be opened to supply their office, as we see often in our Patients whose noses are stopped with a cold, they sleepe with their mouths open, drawing and yeelding their breath thereby least the man should be strangled.

The diuision of each hole.

It is further to bee noted that the holes of both the nostrilles (which is but one in one nostrill) about the middle of the Nose are deuided into two parts, as *Galen* obserued in his Book *de Odoratus organo*. The one part runneth aboue the palate into the vtmost part of the mouth and throate; whence it is that oftentimes we see that if a man laugh when he is a drinking the drinke will come out at his nosethrils: and those Irrhines which we cast into the nose sometimes for medicine, will fall into the mouth if the nose be close shut. The other part of the hole of the Nose ascendeth to the spongy bone. Finally, the outward parts of the Nose which compasse the holes are called πτέρυγια *ala pinnæ*, The wings of the Nose.

The Nose consisteth of a Cuticle, a Skinne, Muscles, Bones, Gristles, and the inward Coate.

The skin.

The Skinne wherewith it is couered is thin, without any fatte that the quantity of the Nose might not exceed, which would haue beene a great deformity; but vnder the partition in the middle of the Nosethrilles there is a rising or prominent fleshy particle neare the top of the lippe, called by *Ruffus* and *Pollux* κίων *Columna* the Pillar which in some men hangeth something outward; it is thicke and fungous so that it resembleth the *Cartilage* or Gristle, (from which notwithstanding we must learn to distinguish it) and in the compasse thereof stand many haires called properly *Vibrissi*, because when we twitch them out it maketh vs shake our heads and sneeze, which is called *capitis vibratio*. The vse of these haires is, that those small Animals that flye about in the ayre should not be drawne into the nose in our Inspiration, but hang in those hairy springes.

The haires.

The muscles

But because in deeper and sudden Inspirations and Expirations the motion of the nostrilles serueth to no final purpose, therefore Nature made thē mouable, & because they were to be moued according to our will and good pleasure, there are certaine muscles inserted into them, some seruing for dilatation, others for constriction; the first open the nosethrils, the other shut them. Those that dilate the nosethrilles are foure; two small ones arising from the cheeke-bones, two others arise from the seame of the fore-head. There are also other foure which constringe the Nose, two arising from the rootes of the wings, the other two are hidden in the cauity of the nose, vnder the coate which compasseth it about; but of these we shall heare more particularly in the booke of Muscles.

CHAP. XXVII. *Of the Bones, Gristles, Vessells, Coate and vse of the Nose.*

The bones.

THE Bones which make the cauity of the Nosethrils are of two sortes: some may bee sayed to be proper to the Nose although they be bones of the vpper Iaw, others are common. The proper are three: two external and one internall, and these reach from the top but to the middle of the Nose, the rest is gristly.

The common Bones are one fixed at the vpper roote of the nose within called προγνοεισθὶς, by *Hippocrates* and *Galen*, and neare it wee finde two other fungous & spongy bones which fill the vpper cauity of the nostrils made for the voyce and the Reception of odours, which are vnited by the bone *Cribri forme*, so that some thinke them to bee partes thereof: but of these in the History of the Bones.

The gristles.

The Gristles of the Nose are fiue: three are before tyed to the circumferences of the bones, and two make the wings, of which we shall intreat amongst the Gristles.

Vessels

The vesselles of the Nose are veines from the Iugular veines, arteries from the sleepy arteries, and nerues from the third coniugation of the braine on either side one.

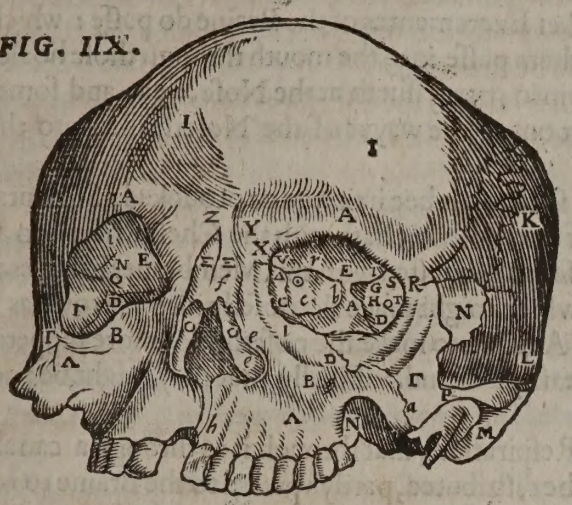
The coat or membrane.

The Coate (which *Galen* in his booke *de instrumento olfactus* calleth sometimes a coat sometimes a membrane, but a membrane most Anatomists call it) which compasseth the capacitie of the nostrils is, as *Vesalius* thinketh, an extension of a branch of the lesser roots of the third coniugation of sinewes. But *Columbus* and *Bauhine* take it to arise from the *Dura meninx*, and it is the common coat of the mouth, the palate, the toung, the *Larynx* or throttle,

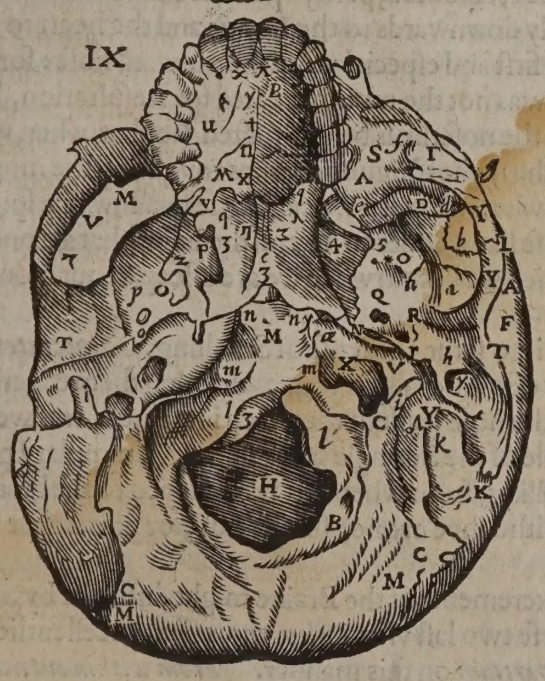
Table xii. Fig. 8. sheweth the foreside of the Scull, as also the bones, the holes or perforations & the Sutures both of the scull and of the vpper Iaw: Figure 9. sheweth the Basis of the Scull, and many holes and Sutures therein.

TABVLA, XII.

FIG. IIX.



IX



AA. A hole in the forehead bone.
BB. The hole of the fourth bone of the vpper iawe, which is in the cheeke.
C. A hole of the second bone of the vpper Iawe in the inward angle of the eye.
DD. The fourth hole of the Wedge-bone in the outward side of the eye. EE. the first hole of the same bone
G. The second hole.
H. the 3. hole of the same bone in the seate of the eye.
II. The forehead bone.
K. The left bone of the *Synciput*.
L. The left bone of the temples.
M, the Mammillarie processe of the temples.
NN, the Wedge bone.
ΓΓΓ, the first bone of the vpper Iaw,
Δ, the second bone of the vpper iaw.
Θ. The third. ΛΛ, the fourth in the left eye.
ΞΞ, the fift bone of the vpper iaw in the Nose.
OO, the bridge or partition of the nosethrils.
P, the Suture in the yoake bone.
Q. A part of the 2. common suture from the first N to S.
R, S, T, V, X, Y, Z. The third common Suture drawn obliquely through the orbe of the eye,
a D, the first externall suture of the vpper Iawe in the Cheeke, and from thence through the eye to Q.
b, the third external suture of the vpper iaw from *b* to *c*.
c, the second external suture of the vpper iaw in the eie
e, the fourth externall suture reaching to *z*.
f, the fixt externall suture of the vpper iaw in the middle of the Nose.
g, the second internall suture in the nose.
h, the seauenth externall suture of the vpper iaw.
i. A bastard suture of the vpper iaw at the eye.

The Ninth Figure.

A. The end of the Coronall Suture.
CC, the lower additaments of the Lambdall suture on either side. D, the fourth hole of the wedge bone in the outside of the orbe of the eye.
F. A part of the fourth proper Suture.
H, the great hole of the *occipitium* made for the spinall marrow. K, A part of the bone called *Synciput*.
LL. A part of the forhead bone. MM, the lower part of the nowle bone. N, A rift or cleft of the wedge bone which is common to the bones of the temple, drawn on the left side from *n* to *o*. OO, the wedge bone P. His foure processes marked 2,3.4,5. A, R. the fixt hole of the wedgebone at the bottom of the throat. A. the seauenth hole of the same at R. Γ. the first bone of the vpper Iaw. S, Λ. the fourth. Π. The fixte, where the Cutter betwixt *c* and Π hath not well expressed the Suture. T T, the bones of the Temples on either side. V, the fourth hole of the bones of the temple made for the hearing. Ξ, the bridge or partition of the nose. X, the fyrst hole of the temple bone in his Basis. YY, the yoake bone. *aa*, the *anterior* part of the fourth proper Suture. *b*, the lower part of the Fift proper oblique Suture. *c*, the lower part of the bridge of the nose which is like a Coulter where 3 is placed. *d*. the vpper part of the second common Suture, *f*, the First externall Suture of the vpper iawe in the Cheeke. *g*, the first common Suture in the side of the brow, *h*, the cauity of the Temples whereto the lower Iaw is articulated. *ii*, the Appendix of the Temple bone called *Styloides*. *k*, the Mammillary processe of the same Temples. *ll*, the knub of the nowle bone. *mm*, the fixt proper oblique Suture of the scull. *nn*. the seauenth transuerse Suture. *op*, A Line beginning from the last named Suture which climbeth by the temples, and is more like a diuision then a line *qq*, the lower part of the second common Suture of the scul in the hollownesse of the nose. *r*, the line of the hole of hearing. *ſ*, *t*, the stony Bones. *tv*, the 5 externall transuerse suture of the vpper iaw. *Xy*, the seauenth externall right Suture. *α*, *β*, A Bastard Suture of the vpper iaw in the pallate. *γ*, the hole of the eare. *δ*, the Fift hole of the temples neere vnto his processe where Y should be blotted out. B, A hole of the nowle bone which is not alwayes found. E. the second hole of the nowle bone made for the sixt coniugatiō of the sinnewes, and for the iugular veine and artery, H. the First hole of the *Occipitium*, or nowle bone for the passage of the marrow. 3, The third hole or the outgate of the seuenth coniugation. *κ*, *λ*, two holes of the nose. *μ ν*, two holes in the palat which is accounted the fourth of the wedge-bone. *ξ*, Fiue holes in the basis of the wedge-bone. *π*, the hole of the fourth Bone of the vpper iaw in the Pallate. Note that M, V, at the right side pointeth out the cauity which the yoke bone maketh for the passage of the temporall Muscles

throttle, the gullet and the ſtomacke. This Membrane although it compaſſe the whole circumference of the mouth and the parts conteyned in the chops, yet is it one and continual, and of one and the ſame ſubſtance, but not alwayes of a like thickneſſe. For in the Noſethrilles it is thinner, but in that part which is vnder the ſpongy bones it is thicker and full of ſmall holes, through which the thicker Excrementes of the Braine do paſſe: which excrements as they deſcend doe part of them paſſe into the mouth through thoſe hoales which are made out of the noſethrils thereinto; part yſſueth at the Noſe, yea, and ſometimes with violent hawking wee fetch part out of the wayes of the Noſethrilles into the mouth.

Why wee ſneeze when our noſe is tickled.

This Membrane is of exquiſite Senſe, ſo that if it bee irritated or prouoked, Sternutation or Sneezing will followe, becauſe of the conſent it hath with the Cheſt whereinto it inſinuateth it ſelfe: but why were the noſethrils inueſted with this Membrane? I anſwere, to hinder the growth of fleſh in the noſe which might make the noſethrilles narrow, as it happeneth in the diſeaſe called *Polypus*. Againe, to make the noſethrilles more ſlipperie that the mucous excrement might more eaſily deſcend. Finally, that they might be partakers of Senſe.

The vſes of the outwarde Noſe.

The vſe of the outward noſe is firſt for Reſpiration, that through it as through a canale or pipe the aire might be conueyed in to be diſtributed, partly vpward to the Braine to recreate and refreſh the Animall ſpirit, partly downwards to the Lungs and the heart to refrigerate and coole the ſame. This is the firſt and eſpecial vſe of the outward noſe: for although we reſpire alſo by the mouth, yet was not the mouth created for Reſpiration, becauſe if the holes of the ſpongye bones or the noſethrils be obſtructed (ſo that when wee ſleepe we draw in our breath by our mouthes) the tongue becomes rough and the mouth dry (ſometimes alſo it growes bitter) that when we wake we can ſcarſe ſwallow our ſpitle. Hence it is, that Nature prouided the noſe like a couer to defend the holes that go out of the noſethrils into the mouth through which we breath when we are aſleep & our mouths ſhut vppe.

That the mouth was not made to breath by.

The ſecond vſe of the outward noſe is to ſerue the ſenſe of Smelling. *Hippocrates de Carn.* ſaith. The moyſt Braine ſmelleth the odours of dry things, drawing them together with the aire through griſtly bodyes. For the noſe leadeth the ayre, informed, as it were, with the formes of odours through the hole of the Spongie bone to the Mammillary proceſſes as vnto the principall organs of ſmelling, from whence it is conueyed to the braine: for if a mans noſe be cut off at the roote, either hee cannot ſmell at all, or at leaſt but imperfectly.

Galen.

The third vſe is, that through it the excrements of the Braine might diſtill, or by a vehement efflation be blowne out. And theſe two laſt vſes *Galen* expreſſeth excellentlie in the ſixt chapter of his eight Booke *de vſu partium* on this manner. *From within outwarde are the Excrements of the Braine deriued through the Noſethrilles. From without inwarde are the Obiects of the ſmelling Faculty tranſported this way. One Inſtrument ſerueth theſe two turnes of Nature; one of which is neceſſary for the preſeruation of Life, the other for our better Life.*

Finally, the Noſe ſerueth to forme the voyce, and addeth a great beauty to the Face.

CHAP. XXVIII. *Of the Inward Noſe and the manner of Smelling.*

THat the Noſe is the Inſtrument of Smelling all men will confeſſe, but becauſe it is compounded of many and diuers parts, it is a great queſtion to which particle among all the reſt the *Action of Smelling* is to bee attributed. Of theſe we haue already examined thoſe parts which make the outward Noſe, it remaineth therefore that we proſecute our Hiſtorie in the parts of the Inward Noſe.

The inwarde noſe made of two parts.

The Inward Noſe therefore conſiſteth of two parts, the bone called *Ethmoeides* or rather the Spongy bone and the Mammillarie proceſſes. The Spongy bone is ſituated partly in the toppe of the Noſethrils, partly within the Scul. It is a couering of the Mammillarie proceſſes thrilled full of holes or rare and Spongye, through which perforations the ayre is immediately conueyed to the Braine for reſpiration, and vapors for the diſtinction of odours: that way alſo the whole fourſe of the excrements is conducted.

The Spongye bone.

The Mammillary proceſſes which make the other part of the inward noſe do proceede out

out of the Braine and haue their habitation within the Scul aboue the cauity or bosome of the spongy bone. Of this spongy Bone we haue sayd somewhat already in the 6. Chapter of the 7. Booke, and shall speake afterward more at large, and concerning the *Mammillary* processes we haue inteated of them sufficiently in the 16. Chapter of the 7. Booke, whether we referre the Reader, and proceede to discouer vnto you the manner of Smelling. And because I would not haue you think that *Hippocrates* was ignorant from whence this Sense came and where it was accomplished, you shall giue mee leaue to relate vnto you a short passage or twaine out of his works. The first is in his Booke *de Carnibus*, where hee speaketh to this purpose.

2. passages out of *Hippocrates*.

The Braine hath in it a Faculty of Smelling though it be moyst, and draweth through gristly bodies which are drie, together with the ayre the odours of drie things. For the Braine reacheth euen vnto the cauity of the Nose, hauing no bone in his way but onely a soft gristle like a sponge, which you can call neither a Bone nor Flesh. If therefore the cauity of the Nostrils bee dry, then doeth the braine better and more exquisitly perceiue the odours of dry bodies. For it cannot smell water because it is moyster then the braine, vnlesse it bee corrupted. In like manner when the Nostrils are moyst we cannot smell, because at such times the braine doeh not draw the Ayre into it selfe.

Againe in his Booke *de locis in Homine. There is no passage tending vnto the Nose* (hee meaneth the Sense of Smelling) *but a loose and spongy substance, and that is the reason why we heare further then wee smell, for if the Sent be far from the Sense it is dispersed before it attaine thereto.*

Galen more distinctly (as being better acquainted with Anatomy) on this manner in a particular discourse of this subiect.. *The Braine sendeth out two sprouts long and hollow, taking their originall from the forward ventricles and determining at that part of the Scull where the Nose beginneth, where are placed certaine Bones called Ossa Ethmoidea*, that is, *like a Syue or Searce*. But we returne to the manner of Smelling.

Galen.

According to *Aristotle* there are three things required, to euery Sense; an Obiect, a *Medium* and an Instrument or Organ.

3. things required to sense

The Obiect here are odours or vapours of a firie Nature.

The Obiect.

But what an odour is, is not so welknowne as what a Sound or a Light, or a Colour is: wherefore in men this Sense is the dullest of all the rest, as *Aristotle* sayeth in his Booke *de Sensu & sensili*, and many creatures Smell a great deale more exquisitly then we; we touch more exquisitly then any other creature, at least that Sence in vs is most perfect. Whence it is that a man receiueth no Smell without pleasure or discontentment, because the Instrument is not perfect.

The Sense of Smelling is the middle Sence, for there are Fiue Senses, two that woorke by contaction, as the Touch and the Taste; and two that apprehend their obiects by the interposition of an other, as Sight and Hearing.

Smelling the middle sense.

Now because Odours are not so manifest (saith *Aristotle* in the 9. Chapter of his second Booke *de Anima*) as Sapours (for our Language vseth the worde Sauour promiscuously in both these Sences) therefore it is that the names of Odours are taken by a similitude from sapors, so that some odours are called sweete, as that of Saffron and Honny; others sharpe as Tyme and such like; there is also a sower Odour, an acute and a satte. VVherefore *Galen* in the 26. Chapter of his 4. Booke *de simpli. medica*. teacheth vs that Odors do moue the Taste as sapors doe; for if our meates be corrupted the Taste is able to find the vnpleasing odour and we throw them away. Yea almost in euery thing the Smell and the Tast haue a mutuall consent; we say almost, because in those things that are most fragrant and sweete smelling as is a Rose, the Smelling and the Taste doe much differ. For the Smell is delighted with the Odour of the Rose, but the Sapor thereof disturbeth the Taste. But as the Hearing is audible and inaudible, the Sight visible and inuisible, so also the Smelling is odorable (for it is no treason to Coyne words) or inodorable. That is inodorable, either that hath not nor can haue any odor, or that which hath but a little odor, or that which hath an euill or offensiue odor, and so much of the Obiect.

Whence odours haue their names.

The consent betweene the smell & the taste.

The *Medium* by which wee Smell is the Aire or VVater. For those creatures which liue in the waters whether they haue bloud or no bloud, are yet apprehensiue of odours, as also those that liue in the Aire. For Fishes and Snayles and those we call *insecta*, do smel their nourishment a farre off, and approach thereupon vnto it, because of the Alimentarie *species* of the odour, as Bees will flock to Honny, and so in the like.

The *medium* of the smell,

How a man smelleth.

But man neuer ſmelleth but when hee draweth in his breath, for if hee hould his breath, though you put odoriferous things into his Noſe he cannot ſmell thē; the reaſon is, becauſe the inſtrument of his Smell is not placed in the ſuperficies of the coat of his noſtrils, but farre within, to which there are certaine perforations that leade. Againe, in inſpiration the inſtruments themſelues are dilated, which if they were not dilated the ayre could not paſſe through the pores nor aſcend vnto the proceſſes and ſo vnto the ventricles of the Braine. Other creatures, euen thoſe that are without blood do ſmell, though they do not reſpire, and they ſmell becauſe they are able to receiue and *perceiue* odours.

That vnbloody creatures do ſmell.

And that they do *perceiue* odours, it is manifeſt, becauſe they are ſtifled with thoſe odors, whereby men are alſo ſtifled. For, ſaith *Ariſtotle* in his booke *de ſenſu & ſenſili*, as men gēt a ſtuffing in their heads, yea are ſometimes ſuffocated with the ſteame of Charcoales, ſo many inſectile creatures are driuen away with the ſmell or vapour of Brimſtone or other Bituminous matter, becauſe they are annoyed, yea killed by them.

A difference of this inſtrument.

Hence it followeth that the inſtrument of ſmelling in men differeth from the inſtrument of ſmelling in ſuch creatures, as a mans eye differs from the eyes of thoſe creatures which haue hard eyes. For thoſe creatures that haue ſoft eyes haue alſo eye-lids to couer them, which lids, if they doe not moue and open they cannot ſee; but thoſe that haue hard eyes haue no lids at all, nor any thing proportionable thereto, but they ſee immediately that which is to be ſeene.

In like maner ſaith the Phyloſopher, in thoſe creatures which doe not reſpire the chiefe inſtrument or Organ of Smelling hath no couer at all no more then their eyes haue. But thoſe creatures which draw in ayre haue their organs of ſight and hearing couered; yet becauſe in their breathing their veines and paſſages are diſtended, the inſtrument is vncouered, or it may bee their breath remooueth the couering away, but when they doe not reſpire they cannot ſmell, which is all otherwiſe in thoſe creatures that doe not reſpire. Hence it is that thoſe creatures that doe reſpire cannot ſmell when they are vnder water, for they muſt reſpire when they ſmell but in the water they cannot reſpire.

Ariſtotles conceit of the couers refuted by *Galen*.

This conceit of *Ariſtotles* concerning the couers of the holes of the Noſe, *Galen* in his booke *de inſtrumento olfactus* refuteth. For, ſaith he, it is an vncertaine thing which cannot be demonſtrated nor made euident, that we ſhould aſſurdly beleeue it to be true: beſide, ſaith *Galen*, it is of no vſe.

But let vs grant that in the bottome of the Noſe there is a couer which is opened by inſpiration, that the way may be made open for the ayre and vapours to paſſe in; and that when the inſpiration is ended, it againe cloſeth: It muſt needs be that the motion of this couer (ſaith *Galen*) muſt be Animall, or Naturall or Violent.

That it is Animall or voluntary no man will ſay, becauſe there is no neede of a couer or value for Animall motion; beſide Animall motion followeth our wills, but this couer is neuer opened ſauing when we draw our breath. Againe, the inſtrument of Animall motion is a muſcle, but in the top of the noſe on the inſide there are no muſcles.

Neither is this motion Natural as is the motion of the valuesof the heart, becauſe the motion of the Heart is perpetuall and not at our command.

An inſtance out of *Galen*.

Violent we cannot ſay it is, for then (ſaith *Galen*) when the Ayre ruſheth forcibly in the couers ſhould be opened euen without attraction or drawing of our breath; but this we are able to diſproue. For put a man into a chamber fulfilled with ſome ſtrong odour, and moue the Ayre neuer ſo vehemently, or lead the ſmell into his noſthrils with a reede (for ſo doubtleſſe thoſe couers if there were any would bee reſerated) yet hee will not ſent the ſmell at all, vnleſſe he draw in his breath. Concerning this matter, he that deſireth further ſatisfaction, let him reade *Galen* diligently. We will proceede vnto the third thing required to ſenſation, which is the Inſtrument.

The inſtrument.

Concerning the inſtrument of Smelling we haue before related the opinion of *Hippocrates*, of *Ariſtotle* anſwered by *Galen*, and alſo of *Galen* himſelfe. But the truth is ſaith *Archangelus* that all the antients were ignorant of this Myſtery.

Amongſt the latter Anatomiſts *Varolius* hath wel deſcribed it, ſo hath our Authour *Bauhine*, you ſhall heare both their conceits.

Varolius.

Varolius hath it thus: Two neruous productions proceed out of the very middeſt of the Braine, wrought as it were out of the ſubſtance thereof; theſe productions ſhooting forward doe determine at the top of the noſtrils and make the chiefe inſtrument of Smelling, to which place when the odoriferous exhalations doe attaine, the inſtrument *perceiueth* the ſpecies of the odor without any matter and into this ſpecies is changed; the exha-

lation is disperſed or extended through the ſubſtance of the Braine.

Bauhine hath it thus: As the Eye is the inſtrument of the Sight, and the Eare of hearing, both of them compounded of many particles: ſo the inſtrument of the Smell is the Noſe. But becauſe in euery ſenſe there is one principall part, it is a great queſtion which is here the principall inſtrument by which the faculty taketh knowledge of the proper obiects of this ſenſe. Some thinke is is the Noſe, becauſe if we ſhut our Noſe and draw in the breath through the Mouth we doe not ſmell at all, but if we drawe our breath through the Noſe, the odour preſently ſtriketh the ſenſe. But becauſe there are ſome creatures that ſmell without Noſes, it followeth that the noſe is not the principall Organ but helpeth the perfection of the ſenſe, and is an aſſiſtant onely to the principall organ. We muſt therefore finde out ſome other part, and that in the Noſe or neere vnto it.

Bauhine.

The principal inſtrument.

Not the Noſe

The Bone it cannot be, ſaith *Galen* in his booke *de inſtrumento olfactus*, becauſe bones are inſenſible euery way, much leſſe can they diſtinguiſh of ſmels. It is not the coate or membrane of the noſe that diſcerneth odours, for though you fill the noſe with odoriferous things, yet we do not ſmell before we draw our breath. Againe this coate is verie like that membrane that inueſteth the vtmoſt part of the heade, which membrane partaketh not of this ſenſe, and therefore not this coate of the noſe. It is not the coate of the Palate, of the Chops, or the Rough Arterie; for if you ſtop your noſethrils & draw your breth through your mouth you ſhall not ſmell at all or feele any ſenſe of an odor, neither about the Pallat, or the Chops, or the Rough Artery. Wherfore the noſe is the way, or the pathe or walke of odoriferous things, although to ſay truth it was ordained rather for Reſpiration, ſaith *Galen*, then to ſmel with.

Galen.

Not the bone

Not the membrane of the noſe.

Nor the palat

The bodie therefore that perceiueth or apprehendeth odours is placed higher, & that is either the Spongie bone or the Mammillarie proceſſes. Not the Spongye bone becauſe, as is ſaid, bones are inſenſible altogether. It remaineth therefore that it muſt be thoſe proceſſes which becauſe they are ſomewhat like the nipples of a Dugge are called *Mammillares*, which proceeding out of the baſis of the Braine are by the *Piamater* (ſaith *Archangelus*) ioyned to the braine and repoſed in the vpper part of the Spongye bone called alſo *Ethmoides* (for wee will confound them) and becauſe they are two, they are diſtinguiſhed or ſeparated by a production of the ſame bone carrying the Figure of a Spur-rowell.

Not the ſpongie bone

But the Mammillarie proceſſes.

They are much of the nature of Nerues, as is before ſhewed in the 16. Chapter of the ſeuenth Book, and therefore are beſt able (ſaith *Laurentius*) to diſcerne of the qualities they receiue: yea (ſaith *Archangelus*) they ſeeme to haue their originall from Nerues of Smelling which do degenerate into them. For from the back part of the marrow of the Braine at the fourth Ventricle doth the Odoratorie Nerue ariſe vnder the Opticke, and pacing forwarde are thruſt into the Mammillary proceſſes betwixt the Braine and the Wedge-bone. And theſe Nerues of Smelling (ſaith he) were made as canales or pipes through which the Faculte of Smelling (reſiding in the Animal ſpirite drawne out of the fourth Ventricle) might be tranſported vnto the Mamillarie proceſſe or the organs of Smelling; as the Faculty of Seeing through the Opticke nerues is tranſported vnto the eyes. The originall of theſe Nerues was vnknowne to *Veſalius*, *Columbus* & the reſt, becauſe haplie they vſed to Diſſect onely putrid or ſtale heades. But wee returne vnto *Bauhine*.

Their nature.

Archangelus conceite of Nerues of Smelling.

Bauhine

Theſe Mammilarie proceſſes (hauing a peculiar Nature, Figure and Compoſition of their own) are eſteemed to be the principall organs of ſmelling, eſpeciallie becauſe there is no part in the noſe which can ſo eaſily be altred by odours as theſe: for being ful of ſpirits they do ſoone receiue the ſpecies of odours. For whereas odours do conſiſt in a kinde of exhalation (which is manifeſt becauſe odoriferous things doe onely ſo farre foorth ſmell as they exhale; whence it is that in Summer the ſents of thinges are more freſh and fragrant then in Winter) and exhalations are naturally drie, it was fit that the organ of Smelling ſhould proceede from a moyſt principle, that by reaſon of the contrarietie betweene the Obiect and the Organ which is neceſſarie in al actions, the inſtrument might ſuffer and be mooued by the exhalation. And becauſe the exhalation when it was come vnto that place might better be dilated or extended, this inſtrument dooth not ariſe from the Spinall Marrow, nor from out of any part compaſſed or conſtrained within narrow limits, but of the verie middeſt of the Braine where they are wrought out of the ſubſtance therof, & thence produced forward determine in the top of the noſe &,

Odors conſiſt in exhalation

ſo

ſo become the Organs of Smelling.

A briefe Collection of the manner of ſmelling

We conclude therefore that the Smell is made after this manner. The Aire altred with Odors or by an aierie exhalation of odoriferous thinges is receiued by the Noſe, which like a Chimney is broad below and narrow aboue; but becauſe the proper motion of the exhalation is but weake that it cannot make a ſufficient impreſsion; it is increaſed by traction. Wherefore when the mouth is ſhut and the Cheſt dilated (for vnleſſe the Cheſt be dilated we can ſmell nothing) the exhalation that is diſperſed through the aire is by inſpiration drawne into the noſethrils: and becauſe out of them there are two holes which go vnto the pallate the greateſt part of that aire ſo drawne in entreth into the Lungs but without any ſenſe of odours; the reſt aſcendeth vpward to the inſtrumets of Smelling, but it is altred in the ſpongie bones euen as in the cauities of the eares the auditorie aire is prepared. This aire thus altred in the Labyrinths of the ſpongie bones together with the ſpecies or forme of the odour paſſeth thorough the holes of the *Siue* into the *Mammillary proceſſes*, or by them it is receiued and ſo conueyed to the common Senſe which is in the Braine that it may iudge thereof. For the Brain is the common inſtrument of Senſation or the organ of all the ſenſes, or it is the inſtrument by which the *Senſatiue Soule* perceiueth all ſenſible qualities, yea diſtinguiſheth and iudgeth of them. And thus much of the vpper part of the Face, wherin three Senſes are ſituated, of which we haue intreated.

CHAP. XXIX. *Of the Parts of the Face which are betwixt the Noſe, the Eares and the Chinne.*

The particular parts, with their names.

THE parts of the Face which are onely in men and vnder the eies between the noſe and the eares reach as farre as the Chin, the Ancients called in Greeke μῆλα, in Latine *Genæ*, becauſe in them haires are generated. Wee call them the Cheeks. They are diuided into an vpper part & a lower. The vpper is next vnder the Eyes, a little riſing between the noſe and the Ears & for the moſt part is red, in which place *Plinie* ſuppoſeth that modeſty or ſhamefaſtnes hath her ſeate, becauſe that part bluſheth in thoſe that are modeſt. *Hippocrates* called it κυκλὸς προσώπου, the circle of the Face, and *Pollux* μῆλον the Apple of the Face, beecauſe in forme and colour it is not vnlike an apple, beſides their colour flouriſheth moſt in the Summer of our age.

The lower part is looſer, and is all that which is without the cloſing of the two Iawes, reaching almoſt all along betweene the chin and the eyes: when your teeth are ſhut you may raiſe it vp with your finger on the inſide, or make it ſtrut when you fill your mouth with Aire, not ſuffering it to go into your Lungs or out of your mouth. This is called in Greeke γνάθος, in Latine *Bucca* the Puffe of the Cheeke: That part which is betwixte the noſethrils and the vpper lip is called *Myſtax*. The cauity which parteth the vpper lip in two which is an impreſsion therein like a valley, is called in Greeke φίλτρον, as it were *amiable or louely*.

Archangelus.

The Lips are cald *Labra* by *Cicero*, by others *Labia a lambendo* of licking, for ſaith *Archangelus*, men lick with their lips though other creatures, as Dogs and Cats and Oxen licke with their tongues. They are two, one vpper another lower, and are nothing elſe but Muſculous extremities of the mouth. *Ariſtotle* in the 11. chapter of his firſt Book *de Hiſtoria Animalium* calleth them χείλεα, becauſe they occupy the verie mouth. *Homer* alſo calleth them χείλεα, and *Lycophron* in that prouerbe vſed I thinke in all Languages.

A prouerbe out of Lycophron.

πολλὰ χειλεὺς χ' ὑπαστράλων πολῶν
μέσω κυλίνδει μοῖρα παμμίλωρ βροτῶν,
Great Deſtinie twixt the Lippe and the ſippe,
Cauſeth ſtrange chances often to ſlippe.

The vtmoſt and prominent parts of the lippes are called προχείλεα, *prolabra* by *Ruffus*, and thoſe parts that meete and looke redder then the reſt becauſe of the affluence of bloode are called προσόμια by *Pollux* and *Ruffus*. The hole which the two lips make when they are diuided is called στόμα, *Os* the mouth. Finally, the lower part of the Face vnder the neather lip which groweth ſharp is called γένειον by *Xenophon*, by *Cicero mentum a memorando* becauſe it ſhould ſeeme there is ſome vſe of it when we deſire to remember any thing. No creature (ſaith *Pliny*) hath a chin but man, which if it be round (according to *Pytha-*

go-

goras) is a signe of an effiminate minde. The doke or dimple in the middeſt of the chin and a great ornament too, is called νύμφη the Nymph; the very ſharp poynt of the chinne, bearing out in the lower law is called ὀξυγενὺς; the fleſh vnder the Chinne is called λευχανία in Latine *Buccula* we call it a double Chinne. To conclude, the hayres that breake out in the Cheekes, the Lippes and the Chinne make the Beard, of all which parts we might diſcourſe at large out of our Authours, but that we haſt to that which is more profitable.

CHAP. XXX. *Of the Mouth, Palate and Vuula.*

THat which is in Greeke called στόμα, in Latin *Os*, we call the *Mouth*, comprehending vnder that appellation not onely the Cleft which is made by the opening of the Lippes, but alſo all that voyde cauity which is betwixt the Lips and the rootes of the Choppes, which are called *Fauces*. It is ſituated in the fore and middle part of the Face, that the handes might equally reach the meate on either ſide vnto it. The mouth.

It is alſo immediatly vnder the Noſtrils, that not onely the Sapors or Taſtes of our meates might be offered to the Mouth; but the Sauours & Smels or Odours to the Noſethrils. For it is fit both the Sences ſhould iudge of that we put into our bellies. The reaſon of the ſcituation.

The parts of the mouth are of two ſortes: ſome are thoſe whereof the Mouth is made, others ſuch as are contayned within the Mouth. The partes whereof the Mouth is made are of two ſorts, ſome fleſhy, others bony. The fleſhy partes are the Lippes; the Muſcles of the Puffe of the Cheekes, of the Lippes and of the lower Iaw. For on the foreſide the Mouth is compaſſed with the Lippes, as well to ſhut vp the Mouth when we would, as alſo the better to ſup liquid things; on each ſide are the Puffes of the Cheek ſwelling out. Theſe partes are couered with the Skinne hauing Fatte vnder it, which Skinne in the middeſt is ſlitte ouerthwart like the Eye-liddes to giue way for the reuiuing of Aliment. The parts of the mouth. The fleſhy.

The Bones are the vpper and the neather Iawes, with the Teeth fixed into them both. The bones.

All theſe parts as alſo the whole inward capacity of the Mouth is compaſſed with a thick membrane which in the palate is ſomewhat rugous, ſpredeth ouer the Gummes, couereth the vpper part of the Lippes, and being reduplicated maketh the *Vuula*. The Pallate.

The chiefe vſe of the mouth is double; firſt to giue way for the aſſumption of meates and drinkes, and that in the mouth they might bee Taſted. For the Taſte is apprehenſiue of that quality of the meat which is fit for our nouriſhment; wherefore in the very ingreſſe of the mouth is the Toung placed which is the proper inſtrument of the Taſt, that nothing may be admitted into the mouth which doth not firſt make his quality manifeſt by the contaction of the Tongue: againe to breake the Aliment and to ſhred and mingle it before it be ſwallowed, that it may go prepared into the ſtomacke. The chiefe vſes of the mouth.

The ſecond principall vſe of the mouth is for Reſpiration, that when the Noſe is ſtopped the Ayre may yet be tranſported, ſome of it vpward to the top of the noſtrilles, ſome of it downward to the Longues, for the nouriſhment and expurgation of the vitall ſpirits: eſpecially for the framing of the voice, for we ſpeake out of our mouths.

The ſecundary or leſſe principall vſe of the mouth is, that thorough it by hauking wee might auoide the excrements of the head, by Coughing the excrements of the Cheſt and the Longues, and ſometimes alſo by Vomiting thoſe of the Stomacke. The ſecondary vſes of the mouth.

The Muſcles common to the Puffe of the Cheekes and the Lippes are foure, twoe on each ſide. The one called *Quadratus* or the ſquare muſcle, the other *Buccinator* or the Trũpeter; and theſe muſcles beſide the vſes they haue in beaſtes do in men helpe the Speach, eſpecially the Sounding of a Trumpet or winding of a Horne or Cornet. The common muſcles.

The Lippes which couer the mouth are two; one aboue, another below, whoſe ſubſtance ſayth *Galen* in his 4. Book *De Anatom. Adminiſtrat.* and the third chapter, are fleſhy, fungous and moouable, and that after an vncouth manner: for the Skinne and the Muſcles are throughout exactly mingled together, ſo that *Galen* in the 11. Book *de vſu partium* and the 15. chapter, calleth the conformation of their ſubſtance a *Muſculous Skinne*, or a skinny Muſcle. The lips.

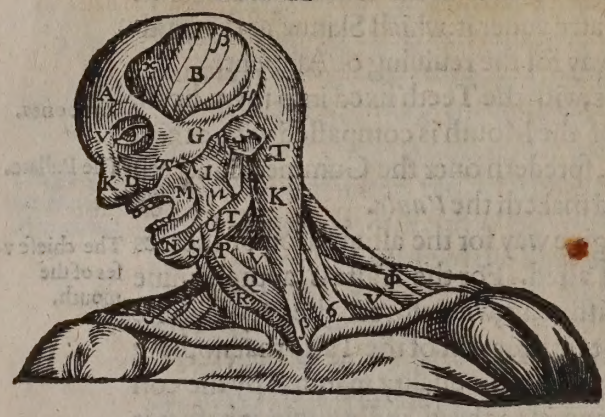
And as without they are couered with the Skin, ſo on the inſide they are inueſted with a membrane common to the ſtomacke and the mouth: whence it is that in thoſe that are about to vomit the lower lip is often ſeene to tremble. Theſe Lippes all creatures haue to eat and drinke with; but men make farther vſe of them to helpe their ſpeach, to auoyde their ſpittle, and moreouer they defend the Teeth from the coldneſſe of the ayre, and are a great

Table 7. Fig. 1. *Sheweth the muſcles of the Fore-head, the Eye-lids, and the Cheekes.*
Figure 2. *ſheweth the muſcles of the Noſe, Lips, the lower Iaw and of the bone* Hyois.

TABVLA. XIII.

FIG. I.

FIG. II.



A 1,2, The muſcle of the forehead and the right fibres thereof.
B 1,2, The temporall muſcle.
αβγ 2, His ſemicircular originall.
CE 1, the firſt muſcle of the Eye-lidde compaſſing the whole lid.
FD 1, the third muſcle of the wing of the noſe which endeth into the vpper lip.
GH 1, the muſcle of the vpper lip.
G 2, The place of the yoke bone without fleſh.
I 1, the broad Mouſe-muſcle ſtretched ouer the cheeks and all the lower parts.
ικζθ the circumſcription or circumference of this muſcle.
II, the yoke-bone.
I 2, The grinding muſcle or the ſecond muſcle of the Iaw.
The forward K in the ſecond figure ſheweth the higher griſtle of the noſe.
L 2, the wing of the noſe.
M 2, a muſcle forming the cheeks.
N 2, the muſcle of the lower lip.
O 2, A part of the fiſt muſcle of the lower iaw called *Digaſtricus*, that is, double bellied.
P 2, the bone *hyois* is ſet in this place,
QR 2, The firſt muſcle of the bone *hyois* growing to the Rough artery,
S 2, the ſecond muſcle of the bone *hyois* vnder the chin
The lower T in the ſecond figure ſheweth the third muſcle of the bone *hyois* ſtreatched to the iaw. The vpper T in the ſecond figure ſheweth the inſertion of the ſeuenth muſcle of the head.
VV 2, two venters of the fourth muſcle of the bone *Hyois*,
The backward K (put in ſtead of *X*) ſheweth the ſeauenth muſcle of the head and his inſertion at the vpper T,
κλ 2, The originall of the grinding muſcle from the yoke-bone,
μ 2 the inſertion of this muſcle into the lower iaw,
ν 2 A ſmall nerue running to the forehead out of the orbe of the eyes, π 2, a nerue propagated to the face, ρσ 2, two beginnings of the ſeauenth muſcle of the head. Τ 2, His inſertion into the *Mammillary* proceſſe. υ 2, The clauicle or the coller-bone. φ 2, A place where the veſſels attayning to the head and the nerues of the arme do paſſe through.

great beauty to the Face.

For the performance of all theſe offices they ſtoode in need of Muſcles, ſome of which are common with them and the Puffe of the Cheeke, of which we haue made mention before: others are proper to the Lips onely, and they are ſixe; two on either ſide belonging to the vpper Lip and one on either ſide belonging to the nether.

The proper muſcles of the Lips.

The Iawes are two. The vpper which in men is immouable, and the lower which is moued voluntarily with a double kinde of motion; one ſimple another compound: the ſimple motions are ſixe, vpward, downward, to the right hand and to the left, forward and backeward.

The Iawes.

The compound motion is made of that which is to the right hand and to the left, and that which is forward and backward: and by this motion the Iaw is *circumduced* or led about. It is mooued vpward by the muſcle called *Temporalis*: downward by *Digaſtricus*, to the right hand and the left by *Manſorius primus*: backeward by *Manſorius alter*: forward by the fift paire: of all which as alſo of the common Muſcles we ſhal intreate in the book of Muſcles and of the Bones in the booke of Bones.

The parts contained in the mouth are diuers beſides the teeth and the bone *Hyois*, of which we ſhall intreate among the bones. Theſe are the Gums, the Palat, the *Vuula*, the Almonds, the Tongue, the Larynx or throtle, the Muſcles of theſe parts, and the beginning

ning of the Gullet.

The Gummes are made of flesh, which *Auerrhoes* saith is glandulous, the *Grecians* call it ὑμὴν ἔνδοτις εἰλεῖν which signifieth to inuolue: it is hard, saith *Bauhine*, and immoueable that so the teeth might be better fastened in their sockets, so hard the gums are that such as haue lost their teeth are able to breake their meate sometimes with them.

The Palate is the vpper part of the mouth, wherefore the antients, as *Hippocrates*, and *Galen* from him call it ὑπερῶα; *Aristotle* οὐρανός, as it were *Cælum oris*. The Latines call it *Palatum*, because it is fenced in with teeth, as it were with Pales, as if one should say *Paled in* [Tab. 13. fig. 4.*.] The extension of the Palate is from the backepart of the mouth to the teeth and is hollow like an Arch, but the roofe is not too high, hence we call it commonly the roofe of the mouth, but those whose heads are acuminated or like a Sugar loafe haue high roofes or palates as *Hippocrates* obserued in the first section of the sixth booke *Epidemion*. This is the foale or basis of the Braine established by the wedge bone, which therefore *Galen* calleth the bone of the palate, though saith he in his nineteenth chapter of his eleuenth booke *de vsu partium*, it scarce touch the palate. The palate.

It is made partly of bony substance and partly of fleshy; the bone is hard and fast lest it shold rot by the confluence of excrement vnto it, as we see it doth in the French disease. This bone is double on both sides, for it is compounded of the fourth bone of the vpper iaw into which the teeth are fastened, and the sixth bone which maketh the backeward amplitude thereof. It is also diuided in the middest by a Suture, in the end whereof are two holes through which the braine is purged into the mouth, and so there becomes a great society betweene the nosthrils and the palate. Through these holes when wee hold our mouths close we may exspire and inspire, breath in and out, and when the wayes of the nostrils are obstructed, the excrements gathered together in the ventricles of the Braine are this way deriued into the mouth. But the backeward halfe of the palate whic endeth into the *Fauces* or chops, & is stretched out from one side to another, consisteth of a thick and glandulous flesh. Whereof framed. The bone of it. The holes of it.

It is inuested with a thicke coate arising out of the *dura mater*, which hauing gotten out of the skull is enlarged, becommeth thicker and compasseth the whole mouth and palate or the inside, yea it is common also with the gullet and the stomach, Hence cometh the great consent betweene the Palate and stomach, for it was fit that the coate of the palate should haue the sense of Tasting, that it might take the assay vnto the stomach. Wherefore the sense of it is more exquisite, as receiuing it into his back part certaine small nerues of the fourth coniugation, which coniugation is also distributed vnto the palate. The coate of the Palate.

This is also the cause why wee cannot euacuate the head with Masticatorie Medicines, but the stomach also will bee euacuated by the palate: now the head is euacuated by the palate, because from the head certaine hairy threds of veynes doe descend vnto the palate.

This coate of the palate in some places is rugous and rugged, which *Plinie* calleth *Crenas*, that the meate might be better mittigated. It is also hollow or concauous, that the voyce might be better formed when the ayre is reuerberated; in this concauity also as in a bosome the ayre we draw in is warmed, that it should not descend cold vnto the vitall parts to offend them. *Plinie.* Why it is hollow.

The *Vuula* hath many names: It is cald *Gargareon*, or *Gargulio* by *Hippoc.* by *Aristotle* κίων, but the proper name is *Gargareon*; κίων & σταφυλὴ, that is *vuula*, are the names of it when it is ill affected. The name *Gargareon* is a made word of the sound we make when we gargle, or else from Gargles which we vse in the diseases of this part. It is called also *Columella & plectrum*, It is a particle of the mouth or a certaine poceſſe saith *Ruffus*, hanging directly downeward (from the inward part of the palate [Tab. 13. fig. 4. E.] neare the holes of the nosthrils which looke into the backepart of the mouth) into the capacity of the mouth betweene the Almonds [F F] aboue the slit of the larynx or throtle [E] as will easily appeare if a man open his mouth wide and presse his tongue downeward. The names of the *Vuula*.

The substance of it is glandulous, red, and fungous hanging downe from the middest of the glandulous part of the palate. Some thinke it is made of the coate of the palate reduplicated at the end of the mouth and a little elongated, this was *Columbus* his conceyt, The substãce.

If it be diseased by a fall of humours it is no more called *Gargareon* but κίων and κιονὶς & σταφυλὴ and ἴμας and ἱμάντων. The names as they are properly giuen.

For if it grow equally thicke from the Basis to the ende, and fall lowe, become redde, then

then it is called κίων, that is, a Piller; but if the vpper part be ſlender, & the lower part grow round and liuid or blackiſh, then is it called σταφυλὴ or the *Vuula*, becauſe it is like a Grape both in colour and in magnitude, the ſtalke being the vpper part. It is called alſo κιονὶς, and therefore *Galen* calleth them in whome it is ill affected κιωνικοὶ.

The vſe of the *Vuula*.

The vſe of it is to temperate and moderate the coldneſſe of the aire we breath in, that it fall not ſuddenly vppon the Longues, and ſo the bloud (ſayth *Aphrodiſæus*) become condenſed and thickned by the Inſpiration of cold ayre, whereby the motion of the Longues might be made ſlower; whence it would follow that vpon ſo great a contention in the motion, the veſſels might be broken and a conſumption follow.

Another.

Another vſe of it is to moderate and Tune the voyce, for onely Men and a few Birdes haue it: hereuppon it is called *plectrum vocis* the quill of the Voyce. For hanging in the cauity of the Palate betwixt the *Larynx* and the cauity of the noſethrilles it maketh a reper-

Columbus.

cuſsion of the ayre as it yſſueth out of the Throttle. Hence alſo it is that it helpeth pronounciation very much as *Columbus* ſayth; who alſo auoucheth that if it be eaten away by the French diſeaſe, or cutt off when it is inflamed, the voyce will neuer be ſhrill or cleere after.

Gainſaide by *Fallopius*.

This *Fallopius* gaineſayeth vpon his owne manifould experience, and *Bauhine* telleth a Storie of a Marchant whoſe *Vuula* (for I know no other name for it in Engliſh) had beene ſome yeares ſince conſumed by a defluxion of ſharpe humours, who yet found no decay or falt in his ſpeech to follow vpon it, marry otherwiſe he grew *Tabid*, that is, into a conſumption. VVherefore, ſayth he, we conceiue that thoſe that haue their voyces impayred by the French diſeaſe, doe not onely looſe their *Vuulas*, but the Vlcers eate away a great part of that glandulous body which is betwixt the Bone and the coate of the Palate, or elſe the bone of the Palate and the membrane is perforated. The like conceit alſo hath *Fallopius*.

A third vſe.

Some adde a third vſe of the *Vuula* to purge the Aire, for it licketh vp the duſt which otherwiſe together with the ayre woulde deſcend into the Longues. But *Veſalius* doeth not approue of this vſe, and hee rendereth this reaſon, becauſe other creatures that drawe their breathes nearer the earth (and ſo more in danger of duſt then men) haue not yet this *Vuula*.

Varolius his vſe of the *Vuula*.

Finally (for I will not inſiſt vpon euery mans conceit) *Varolius* concerning the vſe of the *Vuula* expreſſeth himſelfe on ſuch a manner.

The *Vuula* receiueth the excrement of the braine conuayed vnto the Phlegmatick glandule through the Tunnell; this excrement it imparteth vnto of the Palat, the Tongue and other inſtruments of the Voice to moyſten them, that which is ouerplus is caſt out by ſpitting and hauking. For as in a Flute the Sound will not bee ſhrill and cleare vnleſſe it bee wet, ſo it is in the voyce of a man: and therefore Nature placed the *Vuula* which receiueth the moyſture of the braine directly ouer the ſlit of the Throttle or *Larynx*, that it together with the rough Artery might better be moyſtned.

CHAP. XXXI. *Of the end of the Mouth called Fauces or the Choppes, and their Glandules.*

The extent of the word.

ALthough the word *Fauces* or the Choppes, doe among ſome Anaomiſtes, *Veſalius* and *Laurentius* eſpecially, ſignifie al the capacity of the mouth; yet properly it ſignifieth the backeward and lower part of the mouth, or that ſpace where the endes of the Gullet and the rough Artery doe meete, and may not be perceiued vnleſſe the mouth be wide opened and the Tongue depreſſed. [Table 13. figu. 4. betwixt F and I] The Grecians call it φάρυγξ. Yet this word φάρυγξ hath diuers ſignifications: ſometimes it is taken for that we call *Fauces* or the Chops, ſometimes for the *Larynx* or Throttle, becauſe they are neare together, ſometimes alſo for the whole rough Artery. *Ariſtotle* in diuers places giueth this name to the Gullet. *Philoxenus Erixius* ſayeth a notable Gourmandizer wiſhed his φάρυγξ (that is his Gullet) bigger then a Cranes. Some by this word vnderſtand all the glandulous bodies about the Choppes. But in *Hippocrates* where wee haue this worde φαρίγγες put by it ſelfe, it ſignifieth ſome diſeaſe of the Chops, as their roughneſſe, as in the fift Aphoriſme of the third Section, or their Inflamations, as in the 7. Section of the ſixt Booke *Epidime.* and the firſt Aphoriſme. This place alſo is called ἰσθμὸς by *Galen*, and ἰσθμιον by *Hippocrates* by a Metaphor, becauſe of the narrowneſſe of the place: for *Iſthmus* ſignifieth properly a narrow tract of ground betwixt two Seas, and in the whole body there is no part ſo narrow

Why it is called *Iſthmus*.

and

and ſtraight which conteineth ſo many inſtruments. For in theſe *Fauces* are contained, firſt, the holes of the noſthrils deſcending through the palate into the mouth [Tab. 13. fig. 4. after E.] of which we haue ſpoken in the hiſtorie of the Noſe; againe, the muſcles of the *Fauces* or Chops, the bone *Hyois* vnder the roote of the tongue, the tong it ſelfe, the Larinx together with the *Epiglottis* and the beginning of the gullet; beſide the muſcles of theſe parts and ſome of the lower iaw. Add hereto certaine propagations of the nerues of the third, ſixt and ſeuenth coniugations, the iugular veines, the ſleepy Arteries, and certaine glandules of which wee will intreate in the next place becauſe they are beſt exhibited in the thirteenth Table. What parts are contained therein.

There are three ſorts of Glandules in the region of the Chops.

The firſt is vnder the roots of the Eares (which *Veſalius* accounteth for the third kind) of which we will ſpeake in the eleuenth booke. The 2. are thoſe they call *Tonſillæ* or the Almonds, of which we will intreate in this place. The third are thoſe (*Veſalius* calleth them the firſt) which grow at the roote of the Larinx on the ſides of the rough Artery, of which we ſhal make mention when we come to the Larinx, but diſcourſe of in the 11. book Three ſorts of glandules neere this place.

The Almonds are commonly called *Tonſillæ* [Tab. 13. fig. 4. F.] *Celſus* calleth them ſimply Glandules. They are ſcituated in both ſides of the Mouth at the rootes of the tongue betwixt the holes of the noſthrils and the Larynx, or betweene the beginnings of the weazon and the gullet, on either ſide one, large, long, and compared to Almonds, and therfore they are commonly called *the Almonds of the throte*. The *Græcians* call them παρίσθμια, becauſe they are ſeated in the *Iſtmus* of which we ſpake euen now. For if you looke into the cauitie of the mouth when the lower iaw is remooued, you ſhall ſee the two holes of the noſthrils and the *Vuula* or *Gargareon*: the two holes like two ſeas, and the *Gagareon* like a narrow tract or necke of land running betweene them. By the ſame name of *Pariſthmia* they vſe alſo to call not onely a part of the *Fauces* or Chops, but alſo the inflammation thereof, yea the diſeaſes of theſe glandules when they are inflamed, or when they ſwell or are reſiccated when they hinder (ſaith *Paulus*) the free paſſage of the drinke or the breath. For their ſwellings ſeldome hinder the paſſage of the meate becauſe being but lax or looſe bodyes the weight of the meate beareth them downe before it, and by this we commonly diſtinguiſh betweene the inflammation of the Muſcles of the Tongue, which we call an *Angina* or Squinſie, and the ſwelling of the Almonds; for in the Squinſie wee cannot ſwallow any thing without great difficultie, and the more ſolid thing the worſe; in the ſwelling of the Almonds we can hardly draw our breath or take downe any liquour, but ſolid meate will goe downe much more eaſily. The almonds

The differẽce betweene the ſwelling of the Almonds and the ſquinſie.

Sometimes alſo by the word *Pariſthmia* is vnderſtood the inflammation onely of the coate which we ſayde was common to the Chops, the whole mouth and the ſtomach; ſometimes the inflammation of thoſe muſcles which lie next vnder the ſaide coate, ſometimes the inflammation of the bodyes which are within the *Fauces*. *Pariſthmia.*

They be alſo called ἀντιάδης by *Hippocrates* in his ſecond booke *de morbis*, becauſe they are placed in oppoſition one vnto another; but this name is not giuen onely to the Glandules but alſo to their diſeaſe, ſo ſaith *Hippocrates* in the place before quoted; It will not bee amiſſe to thruſt your finger into your mouth and to beare downe the *Antiades*, that is, the Almonds when they are ſwelled. Yet ſome put a difference betweene *Antiades* & *Pariſthmia*, for they ſay, that the Almonds themſelues inflamed are called *Antiadas*, and the inflamation of the parts about the Almonds *Pariſthmia*. So ſaith *Celſus*, the *Græcians* call the Almonds which are hard after their inflammation ἀντιάδας. *Antiades.*

They are couered with the common coate of the mouth and the other parts of which we ſpake lately which is neruous and in many places perforated with large and ample holes, inſomuch that ſome haue ſayde it is fungous. Theſe holes ſaith *Fallopius*, if the glandules be a little ſwelled, are wont to deceiue Chyrurgions, for they take them to bee Vlcers, whereas indeed there are no Vlcers at all; for when the glandules fall they become againe according to their wonted nature. They alſo receiue veines from the iugulars. Their ſubſtance is like that of the glandules, but more rare, ſpongy and fungous, and therefore *Hyppocrates* in his fourth book *Epidemion* cals them σπόγγοι Sponges, becauſe after the manner of Sponges they drinke vp humidirie, yet *Hippocrates* alſo calleth their tumors by the name of σπόγγοι. How couered

A good note for Chyrurgions.

The vſe of the Almonds is ſaith *Hippocrates* in his booke *de Glandulis*, to receiue the moyſture of the brayne: this moyſture it conuerteth into ſpittle, whereby all the parts with- The vſe of the Almonds.

in the mouth are moyſtned (the Tongue kept from drying, made more glib and nimble) euen the gullet and the weazon. It helpeth alſo the Senſe of Taſting, for we cannot Taſt without moyſture; like as in the ſtomacke there is no concoction or mittigation without boyling, whereof they haue experience whoſe Tongues are rough and dry.

CHAP. XXXII. *Of the Tongue and his Muſcles.*

The names.

THE Tongue is called in Greeke γλῶττα in Latin *Lingua*, of licking, or becauſe it is as it were tyed within the pale of the Teeth ſayeth *Varro*. It is a notable inſtrument both of the Taſte and of the Voyce; becauſe in the Mouth it is placed next vnder the Palate [Table 13. fig. 4. I] in the way, ſayth *Cicero* 2. *de Nat. Deorum*, which Nature prepared for the paſſage of meats and drinks. The Baſis of it reſteth vppon the bone *Hyois* aboue which it is mooued, and neare the *Epiglottis* it maketh an angle or corner, and from thence hangeth and walketh freely in the mouth.

The place.

It was fit (ſayeth *Galen* in the fift chapter of his 8. Booke *de vſu partium*) that it ſhould be placed neare the braine as are the reſt of the inſtruments of the Senſes, becauſe it is the principall inſtrument of the Taſte. Wherefore Nature for the Tongues ſake placed the Mouth in the Head that it might haue a den or caue or chamber to moue in, that it might bee a conuenient inſtrument both of the Taſte and of the Voice, as alſo might helpe the chewing and ſwallowing of the meat.

The figure.

The figure of the Tongue is not alike in all Creatures, in ſome it is *Tri-fanged* as in Serpents, in others *Bi-fanged* as in Lizards; ſome haue two Tongues as the Sea-Calfe. In Fiſhes it is faſtned all along, in Lions and Leopards it is rough and furrowed, but in man it is ſomewhat long, thicke at the roote for ſtrength, and broade that it might bee fit both for Taſte and Speach. In the end it becommeth by degrees ſharpe for quicker motion ſayeth *Galen* in the 10. chap. of the 11. book *de vſu partium*. *Archangelus* compareth it to a *Pyramis*.

The vpper and rough part, called ἐπιγλωττὶς is hollowed on either ſide, thoſe they call χηραμὸι and παράταμα.

It is ſoft, broade and looſe or at liberty that it may be conuayed, produced, dilated and diuerſly diſpoſed; for in thoſe that are tongue-tyed wee ſee a manifeſt defect of vtterance. We may alſo obſerue out of *Ariſtotle* in the 17. chapter of his ſecond Booke *de partibus Animalium*, that thoſe Birds which can bee taught to prattle haue broade Tongues aboue other birds: and the reaſon why bruite beaſtes cannot deuide or articulate their voyce is becauſe their Tongues are hard, thick and not at liberty.

The magnitude.

The magnitude of the Tongue is not all one in all creatures, but proportionable for the kinde whereof they are. Neither is the quantity of it all one in all men; but it is longer then broade, and broader then thicke, and alſo proportionable for the amplitude of the Mouth, ſayeth *Galen* in the tenth Chapter of his eleauenth booke *de vſu partium*, that it might reach into euery corner and nooke thereof, and not hinder the receiuing of meate. But it is faulty ſometimes in magnitude, ſometimes in the very ſubſtance together with his muſcles. For if it be bigge it filleth vp the ſpaces of the mouth and the Chops,

Blæſi. Balbi.

and then it cannot mooue ſo deliuerly or nimbly as otherwiſe it would, and ſuch men are called *blæſi* and *balbutientes*, that is Liſpers and Stutters, eſpecially if (as it happeneth moſt

What childrē ſpeak ſlowly.

what) it bee alſo too ſoft or moyſt. Hence it is that Infants and thoſe children that are moyſter then ordinary doe ſpeake ſlower then others, becauſe of the ſoftneſſe and looſenes of their Tongues and the muſcles thereof, till when their heate by their age encreaſing the ouer aboundant moyſture be conſumed. The Tongue alſo ſometimes is too ſhort when the *Bridle* thereof is not enough cut, ſo then it is hindered that it cannot apply it ſelfe on euery ſide to the Mouth; or becauſe the muſcles being little it is mooued too ſwiftly and ſo implicateth or doubleth the ſpeach and maketh the words come hudling together.

The connexions of the tongue.

It is tyed to the *Larynx*, to the bone *Hyois* vpon which the rootes thereof reſteth as vpon a Baſis and by which it is ſupported, to the Choppes alſo, and on both ſides to the Almonds; below it is faſtned with a ligament.

Whereof cō-pounded.

The Tongue is compounded of a proper fleſh, a coate, nerues, veines, arteries, muſcles and a ligament.

The ligament

The ligament is [Table 14. fig. 3. II] very ſtrong, membranous and broade, and is vnder the middeſt of the body thereof.

The vſe of this ligament is manifould: for the ſolidity and ſtrength thereof lifteth vp the Tongue, and not onely ſo but auaileth much to lill it foorth. For were it not for this liga-

Table 14. *Figure* 1. *and* 2. *ſheweth the tongue cut from the bodie, and the Muſcles thereof. In the firſt the right ſide of it, & in the ſecond his Muſcles ſomewhat vncouered.*

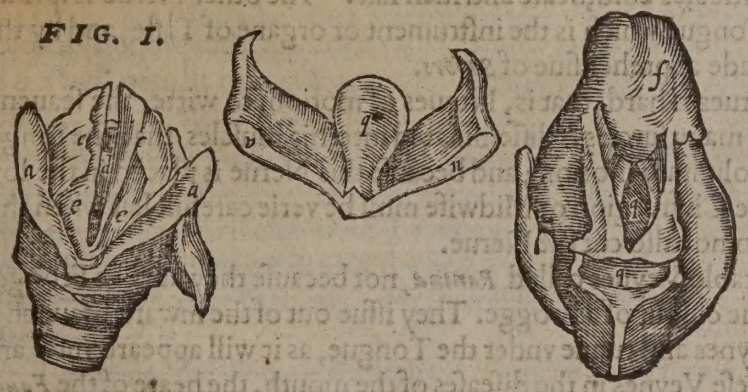
Figure 3. *ſteweth the bodie of the Tongue diuided according to the length of it and his Ligament.*

TABVLA. XIIII.

Tab. 14. *figure* 1. *ſheweth the Larynx, hauing the Shielde Griſtle cut into two parts, but one part of it together with the* Epiglottis *is inuerted as by the Letters may be perceiued.*

Figure 2. *exhibiteth the Larynx ſhewing the* Glottis.

FIG. II.



AAA. The Tongue inueſted with a Coate common to the mouth.

BB. A portion of the coat compaſſing the mouth cut frō the mouth according to the ſides of the lower iaw.

C A part of the ſame coat cut from the inner part of the Palat together with the tongue.

D. The Muſcles caled *Baſi-Gloſſi*, according to *Veſalius* the firſt, but in our account the fourth, or the ſixt of the bone *Hyois* according to *Falopius*.

E. The Muſcles cald *Ceratogloſſi*, or the ſecond Muſcle according to *Veſalius*, and in our account the fifte.

F. The Muſcles called *Styloglossi* or the third Muſcle.

G. The Muſcles called *Myloglossi*, or the fourth Muſcle according to *Veſalius*.

H. The fleſh conſiſting of the Glādules, or the ninth Muſcle of the Tongue according to *Veſalius*.

II. The Ligament of the Tongue.

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The Second Figure.

a 1. The *Shield-griſtle* Diſſected.

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f. 2. The opening Muſcle or the latter *Crycoarythænoides*.

g. 2. The tranſuerſe Muſcle or the *Arytænoydes*.

ligament the Tongue would be too much gathered backward, neither when it is ſhot out of the mouth could it bee eaſily retracted or drawne in againe. Moreouer, if it were on euerie ſide free and looſe it had not beene ſo firmely eſtabliſhed and faſtened in his proper ſeate. This Ligament alſo receyueth the inſertion, ſaith *Veſalius*, of the proper Muſcles of the Tongue which otherwiſe would eaſily haue bene relaxed or looſened or elſe parted aſunder. At the end of this Ligament toward the tip of the tongue there groweth a little Chord which *Arantius* and *Lawrentius* call the *Bridle* of the Tongue. For a mans Tongue in new borne infants is faſtened euen vnto the end with a Tye which the Midwiues do vſe to teare with their Nailes, ſometimes it is faine to be cut, becauſe it is a hinderance to their ſpeech, yea to their ſucking, becauſe it cannot lappe it ſelfe ſo well about the nipple. The tongue therefore beeing naturally nimble and voluble leaſt that it ſhoulde bee alwayes importunately pratling, is reſtrayned by this Tye, as it were by a Bridle. Wherefore, by the helpe of the Ligament and the Bridle and of manie Muſcles working together and contracted towards their originall, the Tongue becommeth nar-

row and pointed, lifted vp and diuerſlie mooued, and withall reſtrained from mooving too farre on any hand.

The coate of the Tongue.

It is inueſted with a coate common to it with the Mouth, the Pallate, the Gullet and the Larynx [Tab.14.fig.1. AA. BB. c] leaſt the laxe and rare ſubſtance thereof ſhoulde part aſunder. This Coate is all verie fine and thin, that the ſapors might more eaſily pierce through it into the pulpe and ſubſtance of the tongue, into which coate as alſo into the fleſh certaine Nerues of exquiſite ſenſe are diſſeminated.

The ſubſtáce of the tongue

The ſubſtance of it is ſoft, looſe, rare and like a Sponge that it might bee the ſooner moiſtened with the humour which carrieth the Sapor in it; and ſo fitter to diſcerne of the diuerſity of Taſtes, for of them it is the competent iudge. Hence it is, that in diſeaſes it is diuerſly affected, for as the humour is that it imbibeth ſo is the ſenſe of Taſting depraued, as we may ſee in thoſe that are ſick of the yellow Iaundiſe or of Agues. The fleſh therefore of the Tongue is proper and peculiar to the Tongue, there being none ſuch in the whole bodie: toward the Baſis it commeth neerer to a Glandulous ſubſtance then to a Muſculous, becauſe it is much ſofter and looſer; yet hath it all manner of fibres, but thoſe ſo intertexed and wouen together that they cannot be ſeparated one from another which may be done in Muſcles.

That it is not Muſculous.

Againe, the Fibres runne through the length of the Muſcles, which is not ſo in the Tongue; for it hath no Ligamentall Fibres to ſtrengthen it as Muſcles haue, vnleſſe it be a middle one which runneth vnder the tongue. Finally, no Nerues from the Braine that ſhould giue it the power of motion do runne through the ſubſtance thereof, wherefore it cannot be called Muſculous, although I know ſome men are of opinion that it is made of two Muſcles ariſing out of the bone *Hyois*, and determining in the tip of the Tongue ſeuered by a white line: ſome ſay alſo there are two other Muſcles of which the pulp of the Tongue is compounded: but if it were made of Muſcles it ſhould onely mooue not taſte, for what Muſcle doth taſte? Wee reſolue therefore that the fleſh of it is not Muſculous.

The Fatte at the rootes.

At the rootes of the Tongue, beſides the Muſcles inſerted thereinto, there adhereth a great quantity of hard fat.

The Nerues of two kinds.

The tongue receiueth two kinds of Nerues, one ſoft which carieth ſenſe vnto it from the third and fourth coniugations, yet ſo that one branch is diſſeminated into the coate that inueſteth the tongue to be an inſtrument of *Touching*, for the Tongue is apprehenſiue of all the *Tactile* qualities, as cold, heate and ſuch like. The other Nerue is ſprinckled into the fleſh of the Tongue which is the inſtrument or organe of Taſte, and by that meanes the Tongue is made apprehenſiue of *Sapors*.

A Caution.

The other kinde of Nerues is hard, that is, Nerues of motion, to witte, the ſeauenth coniugation, which with many ſurcles is diſſeminated into his muſcles that the tongue might be mooued with voluntary motion; and becauſe this Nerue is placed in the lower part of the Tongue, the Chyrurgion or Midwife muſt be verie carefull leſt when they cut the Ligament they do not alſo cut the Nerue.

The Veines.

It hath alſo two notable Veynes called *Ranina*, not becauſe they are like Frogges, but becauſe they are of the colour of a Frogge. They iſſue out of the inward braunch of the externall Iugular Veynes and runne vnder the Tongue, as it will appeare vnto anie man that lifteth it vp. Theſe Veynes in the diſeaſes of the mouth, the heate of the *Fauces* the Squinſie and ſuch like, are opened for deriuation; after the blood is euacuated and reuelled by the opening of the Humerarie Veine of the Arme.

The Arteries.

It hath alſo two large Arteries on either ſide one from the ſleepie Arteries which accompany the Veynes. Theſe are allowed to the tongue to maintaine the life of it, as the Veines were to ſupply it with nouriſhment.

The bodie of it.

The body of the Tongue although it bee continuall not diuided by any partition, whereby it becommeth fitter to Taſte with, to breake the meate, and to articulate the voyce: yet it is diuided or rather ſcored thorough the middeſt with a white line, which *Hippocrates in Coacis* firſt called δίχρων, that is, the *Median*, which Line runneth thorough the verie middeſt of the ſurface of the tongue diuiding it into a right ſide and a left, yet not as it is in Lizardes whoſe Tongues are forked; ſo that the Tongue as all other the Inſtruments of the Senſes is double, and therefore *Galen* calleth it a *Double Member*.

The vſes of the tongue.

The Vſes of the Tongue, although it be but a little Member yet it is of great vſe, becauſe it expreſſeth all the conceites of the minde, wherefore our wiſe Creator hath de-

ſended

fended it with many Teeth, with Lippes, and restrained it with a Bridle, that beeing so carefully attended it might not runne before the minde, which first ought to consulte and deliberate before the Tongue pronounce any thing.

The vse therefore of the Tongue is either primary or secondary. The primarie vse is, that it might be a conuenient and fit organ or instrument both of the Sense of Tasting & of the Speech. Of the Taste (which vse of the Tongue is common to Man and beast) to distinguish betweene all the varieties of Sapors; wherefore *Aristotle* in the 11. chapter of his first booke *de Historia Animalium* saith, there is in the mouth γλῶττα χυμῶν αἰσθητικόν, A Tongue which is the Sensator of Tastes. The taste which the Tongue hath it receyueth especiallie from the Coate which inuesteth the mouth, and particularly from that part of it which couereth the tongue. For whilst wee chew our meate the Tongue rowleth it selfe on euerie side of the mouth and applyeth it selfe to the Viands to take a say or Taste of them. The primarie vse. For Tasting.

Moreouer, because we can thrust or lill out our Tongues, we are able to discerne of the Sapors of those things also which are without the mouth if the Tongue do but touch them, especially with the very tip, for there saith *Aristotle* the taste is most quicke in the 27 chapter of his second booke *De partibus Animalium*, and therefore saith he, in Fishes onely the very tippe of the tongue is loose, the rest is fastened downe vnto the Soale of the mouth. The tip of the Tongue.

Concerning the vse of the Tongue in the voice, *Hippocrates* hath made mention in his Booke *De Carnibus*. As also *Aristotle* in the eight chapter of his second booke *De Anima*, for it is the very organ of Articulation, so we saide before that those Birdes which haue broad tongues may easiest be taught to prattle, as we see in Parrats. *Euripides* therefore calleth the Tongue ἄγγελον λόγων, *The Messenger of the Speech*. And therefore a mans Tongue which is the best proportioned and most at libertie, attaineth to the greatest perfection in the deliuery and variety of the voice. For although a Parrat, a Stare, and such like Birds can moderate their Tongues to a kinde of faigned distinction of Sounds, yet in man the sound is more expresse and better articulated. Beside, sayeth *Hippocrates* in his Booke of the *Epilepsie*, the Tongue of a man is the messenger of the Braine, that is, as *Bauhine* well enterpreteth it of the *Vnderstanding* and the *Wil*; but in other Creatures it deliuereth onely the affections of the Sensatiue soule which *Galen* calles *Rationem delitescentem*, *A silent shadow of reason*, which he attributeth to all creatures deuoyde of reason. So we see euen in the tongue of a man, sometimes it expresseth onelie those rhings that fall vnder the Sense, as when wee crie for paine, or for Foode and succour; sometimes those things that fall vnder our vnderstanding as in Discourse. For Speech. A mans toung the Messenger of the Braine.

The Secondarie Vse of the Tongue is for mastication or chewing, or breaking of the meate, and for diglutition or Swallowing. The Secondarie vse Chewing.

By this motion of the Tongue those Creatures that want Teeth doe swallow their meate whole, as Birdes; and those that haue Teeth doe with theyr Tongues mooue their Viandes vnto their Teeth whereby they are mittigated and broken, and so receyue in the mouth a good preparation for the Stomacke, which otherwise woulde not nor coulde not so easilie concoct them, for shredde meate is more easiler boyled then a vvhole Ioynt.

Againe, the Tongue helpeth the Diglutition by turning the meate ouer it towards the Gullet. By the Tongue also wee can licke and whistle, or varrie the sounde of anie Fife or Pipe, or such like. All these good offices the Tongue dooth in a man, in other Creatures but one or at least not all. For in the perfection of Creatures (sayeth *Galen* in the Fifte Chapter of his seconde Booke *De Semine*, Nature proceedeth by degrees from a Plant. The first Degree, is of those Creatures which haue onelie the Sense of Touching; more perfect are those that Taste, yet more that Smell, then those that Heare: and finally, she addeth the Sense of Seeing which is the vtmost perfection of the sensatiue Soule. Swallowing. Degrees of perfection in Creatures.

The Muscles of the Tongue are assistant vnto it in the performance of all his Functions of Speaking, Tasting and Rowling of the Meate: and therefore there are three kinde of Muscles belonging vnto it which wee may call *Locutorij*, *Gustatorij* and *Cibi reuolutores*, the Speaking, the Tasting and the Rowling Muscles. The Muscles of the tongue

Table 14. *Figure* 1. *and* 2. *ſheweth the tongue cut from the bodie, and the Muſcles thereof. In the firſt the right ſide of it, & in the ſecond his Muſcles ſomewhat vncouered.*

Figure 3. *ſteweth the bodie of the Tongue diuided according to the length of it and his Ligament.*

TABVLA. XIIII.

FIG. I.

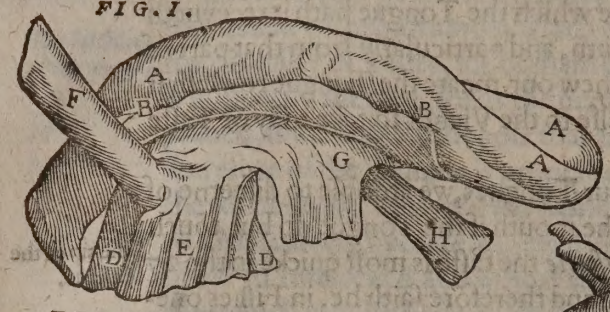

FIG II.

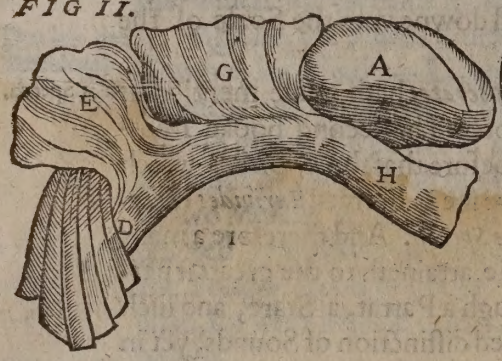

FIG. III.

Tab. 14 *figure* 1. *ſheweth the Larynx, hauing the Shielde Griſtle cut into two parts, but one part of it together with the* Epiglottis *is inuerted as by the Letters may be perceiued.*

Figure 2. *exhibiteth the Larynx ſhewing the* Glottis.

FIG. II.

FIG. I.

AAA. The Tongue inueſted with a Coate common to the mouth.

BB. A portion of the coate compaſſing the mouth cut frō the mouth according to the ſides of the lower iaw.

C A part of the ſame coat cut from the inner parte of the Palate tother with the tongue.

D. The Muſcles cald *Baſi-Gloſsi*, according to *Veſalius* the firſt, but in our account the fourth, or the ſixt of the bone *Hyoïs* according to *Falopius*.

E. The Muſcles cald *Ceratogloſsi*, or the ſecond Muſcle according to *Veſalius*, and in our account the fifte.

F. The Muſcles called *Styloglossi* or the third Muſcle.

G. The Muſcles called *Myloglossi*, or the fourth Muſcle according to *Veſalius*.

H. The fleſh conſiſting of the Glādules, or the ninth Muſcle of the Tongue according to *Veſalius*.

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a 1. The *Shield-griſtle* Diſſected.

b 1. The *Epiglottis* or After-tongue.

c, c. The *Arytænoides* or the Ewre-griſtle.

d, 1, 2. The *glottis* or ſmall cleſte of the Throttle.

ee, 1. The internall Muſcle forming this cleft or the internall Shield-griſtle.

f. 2. The opening Muſcle or the latter *Crycoarythænoides*.

g. 2. The tranſuerſe Muſcle or the *Arytænoydes*.

The chiefe vſe of it in man is ſpeech, the chiefe vſe in Beaſts is taſting, becauſe they want hands to gather and apply their meate vnto their mouthes as men haue: but both men and beaſts when their meate is in their mouths doe rowle it with their tongue, or turne it ouer into their Gullets. The tongue muſt therefore be mooueable & haue Muſcles, which Muſcles are of two ſorts, ſome Common, others Proper. Thoſe are accounted common Muſcles which belong vnto the bone *Hyois*, and thoſe proper which haue their originall from other where, and do determine into the ſubſtance of the Tongue, &

Fiue paire. they are accounted fiue paire called *Stylogloſsi*, [Tab. 14. fig. 1, 2. F] *Myloglossi*, [Tab. 14. fig. 1, 2. G] *Geneogloſsi*, [Tab. 14. fig. 1, 2. H] *Baſigloſsi* or *Trſigloſsi*, [Ta. 14. fig. 1, 2. I K] & *Ceratogloſsi*. [Tab. 14. fig. 1. 2. E] But of theſe we ſhall entreat particularly in the Book of Muſcles, heere it is enough to haue pointed them out.

The roote of the Tongue. Theſe Muſcles being remooued, at the roote of the tongue there appeareth a kinde of fleſh made of many glandules and fat mixed together, which ſaith *Archangelus* doth not deſerue the name of a Muſcle, ſo ſaith alſo *Columbus*, yet hee reckons it for the 11. Muſcle

cle, becauſe the Anatomiſts before him accoũted it for a muſcle. But a muſcle is not made of glandules but of fleſhy fibres.

This heape of Glandules [Table 14.figur.1.2. H] groweth to the roote of the Tongue that it might continually be moiſtned, for without moiſture there can be no Guſtation. So in the ſtomacke there can be no concoction without Elixation or boyling, wherefore Nature ioyned to the Stomacke the *Pancreas* or Sweete-bread a glandulous body, that from thence might continually ſteame moyſt vapours, that ſo the concoction of the ſtomacke might be made by *Elixation* or boyling. Beſide, the moyſture which the Tongue receiueth from theſe glandules makes it more glib and eaſily to be moued; for if it be dryed it wil not mooue ſo readily, as wee may ſee in thoſe that are very drie, & in hot burning Agues when the humour or moyſture of the Tongue is exhauſted. Beſide the Glandules, the Almonds alſo of the throat (as we remembred before) do continually moyſten the Tongue and help his motion. And thus much of the Tongue.

The vſe of the kernels.

CHAP. XXXIII. *Of the Senſe of Taſting.*

WEE ſayd before that there were three things required in euery Senſe; the Inſtrument, the *Medium* and the Obiect. Which three wee will ſhew in this fourth Senſe of Taſting as far as we can gather out of Anatomy.

The inſtrument of taſting.

The Phyſitians following *Galen* in his book *de inſtrumento odoratus*, and in the fift chapter of his 7. booke *de Placitis*, doe determine that the inſtrument of the Taſte is the Tongue, and that it is affected to Sapors as the Eie is to colours. But as in the Eie there is one particle which is ſaid to be the moſt principal inſtrument of Seeing, the other but aſsiſtant: ſo in the Tongue there is one ſimilar part which is the moſt principall inſtrument of Taſting, and that is the rare and laxe ſubſtance thereof, which is therefore rare & ſpongy, that it might be better ſteeped with the moyſture wherein the Sapors are conuayed. The other parts of the Tongue are but helpers and handmaids all contributing vnto the principall part. This ſubſtance, call it fleſh, or pulpe, or what you will, becauſe it was made to receiue all Sapors was to be deuoyde of all Sapor, that is *inſiped* or hauing no Taſte at all as we vſually ſpeake, and that it is ſo any man may perceiue if hee eat of the Tongue of any beaſt boyled freſh and without any ſauce.

The principal particle.

The matter wherein the formes of Sapors do conſiſt which wee call *Natura ſubiecta*, is moyſt: for without moyſture (ſayth the Philoſopher in the 10. chapter of his 2. booke *de Anima*) nothing can make an impreſsion of a Sapor, and euery thing that maketh this kind of Senſation or moueth this Senſe hath humidity in it, either *Actu* or *potentia*, that is, eyther Actually and Really or in Poſsibilitie; and by how much a thing is the moyſter, by ſo much is it the more ſauoury, becauſe all things when they are moyſt doe make a better impreſsion of their Sauour then when they are hard.

The matter in which taſts doe conſiſt.

Hence it is that thoſe things that are hard as Pepper and ſuch like, do not make ſhew of the guſtile qualities vnleſſe their vpper & ſuperficial parts do giue, or melt, or be moiſtned. The ſweetneſſe of Sugar we Taſte better when it is melted, and a corne of Salt will ſtrike the Senſe much more after it is diſſolued then before. An infuſion of Rheubarbe is much bitterer then a peece Rheubarbe held in a mans mouth. Seeing then that Sapors are not perceiued but as they communicate their qualities to moyſte ſubſtances, it followeth that the inſtrument of this Senſe muſt neither be actually moyſt, neither yet of ſuch a ſubſtance as cannot be moyſtned: but it muſt be Potentially Moyſte and Actually moyſtned; yet ſo that when it is moyſtned the Nature of it muſt be preſerued.

Hence it is that when the Tongue is either too dry or too moyſt it doth not Taſte well. For example, if a man Taſte of any ſharpe or vehement thing as Pepper, and then preſently Taſt of an other thing, he is not able to iudge well of the latter; the reaſon is becauſe the Tongue is already poſſeſſed and foreſtaled or taken vp with the former ſharpe humour. So likewiſe we ſee that thoſe that are ſicke think all things bitter, the reaſon is becauſe their Tongues are moyſtned with a bitter iuice.

Why ſick folk thinke al things bitter.

The Tongue therefore was made of an earthy and dry ſubſtance; for albeit becauſe of the ſoftneſſe it may ſeeme to bee moyſte, yet this moyſture is not *Innate* but an acquired moyſture diſtilling perpetually out of the braine which inſinuateth it ſelfe into the Toung as water doeth into a ſponge. That this is ſo it is euident, for if the diſtilation out of the head be ſtayed, the Tongue is preſently exiccated, yea ſo parched by hot vapours eleuated from the Liuer, the Stomacke and the Lungs, that it becommeth rough, yea in Agues it

cleaueth

cleaueth or choppeth and the marks or ſcarres of thoſe fiſſures remaine many yeares to be ſeene; which thing (ſayeth *Bauhine*) I haue experience of in my ſelfe, for 17. yeares ſince I had an Ague, and my Tongue claue or chopped in the middeſt, and yet the marke of it is manifeſtly to be ſeene.

Bauhine of himſelfe

Galen.

Galen therefore in his Booke *de Odoratus Organo*, and in the ſixt chapter of his ſeuenth Booke *de Placitis*, hath truely taught vs that the inſtrument of Taſting was made of a moyſt ſubſtance, where hee intendeth to diliuer the qualities of the inſtruments which are moſt appropriate to the perticular Senſes. For if the Tongue be too much exiccated, the *Perceiuance* or knowledge of Sapours muſt needes periſh: and therefore Nature ſet the Almonds neare the Tongue leaſt the ayre that is continually drawne and let out by Inſpiration and Expiration ſhould drie it too much. And ſo much of the Inſtrument.

The *Medium* of the taſte.

The *Medium* of this Senſe wee take to bee the coate of the Tongue, as the Cuticle or Scarſe-skinne is the *medium* of the Touch. For (ſayth the Philoſopher in the 114. Text of the ſecond Booke *de Anima*) all things that apprehend by any Senſation we apprehend by a *Medium*, there being no Senſation made by the immediat contaction of the Inſtrument and the Obiect, although afterward in the 10. chapter of the ſame booke (not ſo well aduiſed) he denyeth that either the Taſte or the Touch haue any *Medium*, to which place we refer him that is deſirous to know his reaſons.

The obiect.

The Obiect of the Taſte are all thinges that haue any Sapour or Guſtable qualities in them. But the qualities of Guſtable things are of two ſortes, ſome properly belonging to the Senſe of Taſting as Sapours. For as the obiect of the Sight is Colour, ſo the obiect of the Taſt is Sapor; yet nothing that is without moyſture exhibiteth any Sapor to the Senſe: others are Common to all the Senſes as the Magnitude of that which is Guſtable, the Nũber, the Situation &c. VVherefore we ſay that the Tong doth Taſte the Sapor of wine, not the wine; yet from this Sapour the Soule gathereth that it is wine which wee Taſte. For wine as it is wine, and ſugar as it is ſugar are not the Obiects of the Faculty of Guſtation, but as they are indowed with Sapors or Guſtable qualities. The Soule indeed by diſcourſe of Reaſon diſtinguiſheth betweene a ſharp Taſte and a bitter, but it is by the mediation of the Senſe of Taſting; when the Senſible qualities of thoſe ſharpe or bitter things do moue and affect the Faculties of Senſation. But that a Sapor may be exactly iudged of or apprehended, the body wherin that Sapor is, muſt be broken between the Palate and the Tong, and therefore the Palate and the Tongue are compaſſed about or inueſted with one and the ſame coate.

Hence it is that euen the Palate helpeth the Taſte, becauſe alſo it receiueth the like diſtribution of the nerues of the ſame coniugation that the tongue hath.

The kinds of ſapors.

The kindes of Sapours as the Philoſopher ſayth, are accounted after the ſame manner with the kinds of Colours. For as white and blacke are contraries, and the other Colours leane to this or that Contrary; ſo *Sweete* and *Bitter* are the two ſimple contraries; to ſweet adheareth that wee call *Fattie*: to *Bitter* that which is *Salt*: and betwixt theſe are Byting, as Pepper, Harſh as vnripe Sloes, Sowre and Sharpe as Vineger. For theſe are the differences of Sapors according to the Philoſopher; concerning which he that will know more let him refort to *Galen* his firſt Book *de ſimplic. Facultat.* where alſo he ſhall finde what was *Platoes* Philoſophy concerning the difference of Sapors.

The concluſion.

VVe conclude that the Tongue as the Inſtrument of the Taſte being neither drye nor too moyſt, nor ſteeped or dewed with any ill iuyce, doeth through his coate as through the true *Medium* Receiue and Perceiue the Sapours that conſiſt in a moyſt body, and that by a Faculty or Power iſſuing from the braine by the nerues of the third and fourth coniugation, and penetrating into the Inſtrument of Taſting, that is, the Fleſh or Pulpe of the Tongue.

For the Faculty (ſayeth *Plato* in *Theæteto*, and *Galen* in the 6. chapter of his 7. booke *de Placitis*) which iſſueth from the firſt Senſator, that is, the Braine, and through the Nerues penetrateth into the particular Organs of the Senſes, and there *Perceiueth* and iudgeth of all their alterations; is a common Faculty: and therefore we call the brayne the Common Senſator, and the apprehenſion thereof the Common Senſe. And thus much of the foure Senſes (The firſt hauing beene diſcourſed of in the ſecond booke. Now wee come vnto the Voyce.

CHAP.

CHAP. XXXIV. *Of the Larinx or Throtle, which is the Organ of the voyce.*

THe Rough Arterie is diuided into the pipe which consisteth of Semicirculer gristles with a membrane, and the head of it which wee call the Larinx. It is called in Greeke λάρυγξ of λαρυγγίζω, which signifieth to cry with open throate: or of the particle λα which of it selfe signifieth nothing but in composition ad-signifieth a kinde of greatnesse, and the word ἀρύω *to draw*, because in the forming of the voyce we draw our breath deepe. Some call it φάρυξ but that is properly vsed for the *Fauces* or Chops; for the Pharinx is before the Larinx: others deriue it of λα and αἴρεσθαι which signifieth to be lifted vp, because when wee swallow or rayse our voyce very high or vtter it very base, the Larinx is eleuated as any man may see with his eyes. Some call it the knot of the Throate. The names and reasons thereof.

The Larinx therefore is the head or vpper end of the Rough Arterie ioyned in continuitie with the *Fauces*, compounded of great gristles (vnlike those that bee in the rest of the weazon both in the figure and magnitude) Muscles, Membranes, and common Organs: to be the first and most principall Organ of the tuning of the voyce; for in it the voice is first formed. What it is.

It is situated in the Necke, because it is the way of the Ayre, and in the very top of Rough Arterie that vnto it the breath which is the matter of the voyce might easily runne vp from the lungs. Neere the Chops also, the mouth and the tongue that the voyce might instantly bee changed into speech. Moreouer, because it was necessary that it should be perpetually dilated and constringed together with the Organs of Respiration, therefore it was placed on the outside afore the Gullet, that it might not be pressed with the weight of any thing lying vpon it: yea and this position is a great furtherance to swallowing also. For when we swallow our meate the Gullet is drawne downeward, but the Larynx resulteth vpward and helpeth the swallow as well by giuing way therto and leauing scope and roome as also by depressing the meate when it starteth vp as that is falling. It is placed in the very middest of the necke because there is but one Throtle, as also other single Organes are placed in the middest, that the body might be equally ballanced. Now there was but one that the voyce might bee but one. For if we should haue vttered two voyces at one time, wee could not but haue confounded two acts or affects of the minde. The situation. And reasons thereof.

The figure is round and circular but imperfect, bunching out before that it might bee more secure from outward iniuries, behind depressed that it might giue way to the Gullet and leaue space to swallow. Againe it was round, that it might bee concauous or hollow, that so the voyce might be more perfect by a plentiful affluence of the breath thervnto out of the lungs. The lower orifice also of the throtle is larger then the vpper (saith *Galen* in the second chapter of his seuenth booke *de vsu partium*) that in expiration the ayre might ascend more plentifully thereunto to make a base voyce. Finally, it is most like a *Quaile call* of any thing in the world which indeede is made in imitation of this worke of Nature. The figure.

The magnitude thereof is diuers according to the diuersitie of the age, which variety the voyce also followeth. For in children when the Larinx is narrow the voyce is sharper, small, or treble because a little ayre is swiftly moued through a narrow passage; on the contrary in old or elder age the Larynx is wider, and receiueth from the Lungs a greater quantity of ayre, whence it is that the motion is not so swift and so the voyce becommeth base; moreouer the length or shortnesse of the Larynx beare a great sway in the basenes or shrilnes of the voyce. The magnitude.

It is tyed to the rough Artery by the helpe of muscles of Membranes, as &also to the Gullet, the Chest, and the bone *Hyois*, moreouer to the principall parts by the meditation of common Organs. The connexion.

The parts whereof the Larinx is compounded are Gristles, Muscles, Membranes, Veines, Arteries and Nerues, together with the Glandules which grew thereto. And it was necessary it should be compounded of such a substance. Gristly, that it might be hard, dense and thicke, able to resist outward iniuries. Againe, because it is the way of the breath it was fit that the cauity should be made of a hard body that might alwayes stand open for egresse and ingresse of the Ayre. For (saith *Galen*) if it had beene made of flesh or a membrane, the hole of it would haue falne and the passage should not haue bene so free for the breath The parts. Why Gristle.

and

and ſo the body haue beene depriued, not of voyce onely, but of life alſo, becauſe the reſpiration would haue bene intercepted.

Why not bony.

If it had bene bony the hardneſſe thereof would haue preſſed vpon the gullet and ſo haue hindred diglutition or ſwallowing, beſide the very weight would haue drawne downe the tongue and the bone *Hyois*, and hindered their actions; it would haue needed great muſcles to haue moued ſo heauy a body which muſt haue taken vp a greater place then in ſo narrow a roome could be allotted to them. And if the bones had beene ſo fine and thinne that all theſe inconueniences had beene preuented, then it would haue eaſily bene broken being placed outward, for bones will not yeeld as griſtles doe.

Columbus opinion that it is bony.

I know well that *Columbus* is of opinion that it is bony in growne men, which hee auoucheth vpon his owne diſſection of innumerable bodyes (thoſe are his words) although he confeſſeth that in young children it is gryſtly as not hauing attained his hardneſſe and ſoliditie. One argument alſo he addeth, which is, that the ſubſtance is medullous or marrowy as he hath often found, in which one thing bones differ from gryſtles. He alſo reprehenderh *Galen* for cutting vp Apes and not obſeruing that their throtles were bony, and *Veſalius* for ſhewing the Throtles of beaſtes in his publike diſſections. But *Fallopius* whom we eſteem the more oculate Anatomiſt ſaith, that ſometimes he hath found the firſt and ſecond gryſtles bony in very old men, yea ſometimes before extreme old age; but the third and the fourth gryſtles, ſaith he, I neuer ſaw bony, neither can I approue of their opinions that thinke the Larynx is bony and not gryſtly, vnleſſe it be imperfect, becauſe Nature intended it to be bony. For (ſaith *Fallopius*) if this were ſo, then we muſt confeſs that no man hath the inſtrument of his voyce perfect till he come to bee old or ſtriken in yeares, which muſt not be granted. Of the ſame mind alſo is *Laurentius*.

Diſproued by *Fallopius*.

Bauhine proceedeth further to prooue it gryſtly on this manner. It is the inſtrument of the voyce, and therefore there muſt be a proportion betweene the ayre that is beaten, & the body which beateth it, that ſo it may reſound for the forming of the voyce; for the voyce is nothing elſe but a percuſsion of the Ayre. And although ſounds doe ariſe from hard bodyes not from ſoft, as a ſponge, a locke of wooll, or ſuch like; for that the Ayre is not broken vnleſſe it light againſt a ſolid, hard and ſmooth body; yet it muſt not bee perfectly hard, for ſuch a one doth not readily cut the ayre, but ouerturns it. Nor too ſoft, for then it yeeldeth and maketh no reſiſtance, and therefore cannot make any ſound. Such a body therefore which yeeldeth moderately, and beateth the ayre gently, is the cauſe of the voyce, now ſuch a body is a griſtle. Finally, it was made griſtly (ſaith *Galen* in the fourth chapter of his booke of the diſſection of the inſtrument of the voyce) that it might be a fit foundation for the other parts whereof the Larynx is compounded: and that the Muſcles might better ariſe therefrom and be implanted thereinto.

Other reaſons why it muſt be griſtly.

Not of one griſtle.

But it was not fit it ſhould be made of one entire griſtle without any articulation, & ſo immoueable, for then it could not haue bene either ſhut or opened, dilated or contracted. It was therefore made of many annexed one to another and hauing motion, not Naturall, ſuch as is in the Arteries, but voluntary depending vpon the will. For the chiefe vſe of it being in inſpirations and exſpirations; it was meete we ſhould be able to moderate it at our pleaſures, add hereto, that being the inſtrument of the voyce to admit or expel our breath, it was more then neceſſary we ſhould haue a voluntary command ouer it. To this purpoſe Nature alſo furniſhed it with muſcles, and them with nerues for motion, veines for nouriſhment, arteries for life, and membranes for their ſtrength. She added alſo glandules to keep them all moyſt.

The number of the griſtles

It is made of 3. griſtles (ſaith *Galen*:) we ſay 4, ſo doth *Fallopius* & diuers others. For the motions of the Larynx they are double, that is wherby it is dilated and conſtringed, ſhut & opened; and therefore there was neede but of two articulations, each of which ſerue each motion. So that the dilatation and conſtriction is made by that articulation which is betwixt the firſt griſtle and the ſecond. The opening and ſhutting by that which is betwene the ſecond and the third.

The muſcles.

The Muſcles of the Larinx are either common or proper, the common Muſcles are ſixe, that is three paire. The firſt paire are called *Bronchy* [Tab. 15. fig. 7. **.] becauſe they cleaue to the rough Arterie. The ſecond paire are called *Hyoeidei*, or rather *Hyothyroeidei*, [Tab. 15. fig. 3. h.] The third paire are called *Oeſophagei* [Tab. 15. fig. 7. ll.] The proper Muſcles are ten or fiue paire, of which ſixe do dilate and foure do conſtringe. Some of theſe are placed forward, ſome backeward, ſome without, ſome within.

The

Table 15. *figure.* 3. *ſheweth ſome Muſcles of the Larynx with a part of the Nerue.*
Figure 4. *ſheweth all the proper Muſcles, the Cleft, the Epiglottis or After-Tongue and the Griſtles.*
Figure 5. *ſheweth the backe part of the Larynxe with the Muſcles ſeparated, the Griſtles and the Epiglottis*
Figure 6. *The foreſide of the Larynx with ſome muſcles.*
Figure 7. *The tranſuerſe Muſcle of the Gullet, alſo two Common Muſcles, together with the Recurrent Nerues*

TABVLA. XV.

b.4,5,6,7. *Epiglottis* or the After tongue.
* 4. The beginning thereof.
† 5. The roote and foundation thereof.
cc. 5. The Griſtle called *Aryt ænoides* or the *Ewre-griſtle*. *d* 4. the *glottis* cleft or whiſtle.
e.4. The internal muſcles belonging to the *ſhield-griſtle* or the 4. pair of proper muſcles
f,4. the backward *Rings-Ewre* muſcles, or the ſecond paire of proper muſcles.
g,4,5. the *Ewr-muſcles* or the fift paire of the proper muſcles.
h.3. The muſcles called *Hyo-thyroides* or the ſecond paire of common muſcles belonging to the bone *Hyois* & the Shield-griſtle of the Larynx. *i*,3,7. the Gullet.
k,3,6. The forepart of the rough Artery.
l,3,7. The muſcles of the Gullet called *æſophagiai* or the third pair of common muſcles.
m.3. A portion of the nerue deſcending into the ſecond paire of common muſcles.
nn,3,4,5. The Shielde-griſtle, parted in the fourth Figure that the *Glottis* & the muſcles might better be ſeene. In the fifte Figure is ſhewed the Hollowe ſide of the Shield-griſtle, in the ſixt the outward and the foreſide.
o.4. The Cauitie or Ventricle.
r. 4. The laterall *Ring-Ewre* muſcles or the third paire of proper muſcles.
ſſ, 4,6. the forward *Ring-ſhield* muſcles or the firſt paire of proper muſcles. In the ſixt figure one of them is ſeparated, the other remaineth in his owne place.
t,5. The ſpine or ridge of the *Ring-griſtle*.
u,6. A cauity in the middeſt of the Shielde-griſtle, made for the *Epiglottis* or After-tongue.
xx.7. The muſcles of the weazon or the firſt paire of common muſcles.
yy,7. The recurrent Nerues.

The firſt paire we cal the forward *Crycothyroidei* [Tab.15.fig.4,[r]. but in the ſixt figure the one is ſeparated, the other remaineth in his proper ſeate.] The ſecond paire we cal the backward *Crycoarthenoidei*. [Tab.15.fig.5,I] The third paire are called the laterall *Crycoarthenoidei* [Tab.15.figure.4,[r]] The fourth paire are called the Internal *Thyroidei* or *Thyroarythenoidei* [Table 15.fig.4.[c]] The fift paire are called *Arytenoidei* [Tab.15.fig.4 and 5.[g]] The larger deſcription and vſe of theſe muſcles looke for in the booke of muſcles. We wil come to the griſtles of the Larynx which we wil handle particularly in this place becauſe they make this notable inſtrument of the voice, and touch them but by the way in the diſcourſe of griſtles.

The Larynx therefore conſiſteth of three griſtles ſay the Ancients, of four ſay manie of the latter Anatomiſts, and we may ſo eſteem them: one called *Thyroides*, the other called *Crycoeides* and the third *Arytenoides* which is double. Theſe griſtles when the muſcles are remooued from their outſide are ſome-what rough or rugged, to yeelde to the muſcles more commodious originall & implantation. But on the inſide they are ſmooth

The Names of the griſtles.

as

as being inueſted with a Membrane, and beſide ſmeared ouer with a ſlimy moyſture. Of theſe Griſtles three are mooued in the modulation or tuning of the voice, that called *Crycoides* is immooueable. The firſt and the ſecond when men grow old become ſo hard that ſome good Anatomiſts haue thought them bony. But we haue proued before that they muſt needs be Griſtly not bonie.

The firſt Griſtle.

The firſt is called in Greeke θυρεοειδὴς the *ſhield-Griſtle*, or ἀσπιδοειδὴς, for ἀσπὶς ſignifyeth a Buckler or Shield. It hath his name from the forme, [Tab. 16. fig. 2. and 3 whole] for it is like the Target that the Ancients were wont to vſe that was not round but long, the forme is yet kept by Herraldes and in Triumphes where painted Shieldes are vſed of this faſhion, the belly a little hollowe and the backe gibbous.

Pomum Adami

This Griſtle lying vnder the bone *Hyois* couereth the forepart ſo as we can touch it, eſpecially in men in whom it buncheth out more then in women, which bunch or knub they call *Pomũ Adami*, *Adams* Apple, as if it ſtucke ſtill in the throate of all his poſterity, whereas the woman ſwallowed it well enough.

Why womens throttles doe not appeare as mens.

But the true reaſon why it appeares in men and ſeldome in women, is becauſe the Glandules which are placed at the Larynx do make their neckes equall & euen.

It hath foure ſides becauſe of the foure proceſſes it hath behinde, for on the back it is not ioynd by the ſides. In an oxe (ſaith *Placentinus*) there are two moſt manifeſt perforations aboue, through which the proper muſcles of the Larynx receiue propagations of the Recurrent ſinnewes.

It is but one Griſtle, although oftentimes there runne a line through the middeſt. [Tab. 16. fig. 2 and 3 betweene ° and ¤] *Veſalius* eſteemeth it two, in men particularly, *Laurentius* eſpecially in women; howſoeuer, it is the largeſt and broadeſt of all the reſt; as taking vp the one halfe of the whole Larynx: it is therefore threefold as bigge as any of the other compaſsing the Larynx and the whiſtle or pipe thereof which we call Glottis. Moreouer in a man it is larger aboue then below.

But one Griſtle.

Connexion.

It is tyed to the bone *Hyois* by his vpper proceſſes, and by the lower to the ſecond Griſtle.

Subſtance.

The ſubſtance of it is Griſtly, thinne yet hard, the better to defend the *Glottis* or whiſtle, and to helpe the breaking of the aire in the forming of the voice. In olde men this Griſtle is ſometimes ſo hard that being exceedingly dried it becommeth Bony, yea ſometimes a very bone. It beginneth to grow harde at the ſides, the middle Line remaining griſtly for the moſt part, yet euen that alſo now and then groweth to be a bone. The exterior ſuperficies of this griſtle is conuex or gibbous, and toward the ends of the ſides it is rough, into which place the firſt paire of the Common Muſcles of the Larynx are inſerted, as alſo thoſe take their originall which we account for the thirde payre of Common muſcles of the Gullet. On the infide it is hollow to forme the long cauity of the Larynx, by which meanes the voice becommeth ful and elegant, for we ſee that hollow things do ſound better then plaine, as it is in bels.

4. Proceſſes.

It hath foure proceſſes, [Ta. 16. fig. 2 and 3. ικλμ] two aboue and two below, on each hand of the ſides one. With the two vppermoſt [Tab. 16. fig. 1. ιχ] it is tyed by a Ligament ſomewhat long to the lower ſides of the bone *Hyois*; [Tab. 16. fig. 1. ββ] which by certaine diſtances is ſtrengthned with little, long, round and griſtly bodies, [Tab. 16. fig. 1. aboue K, I] eſpecially it hath vſe of them when the Tongue is put out or drawne in again.

The two lower proceſſes in men are ſhorter then the vpper, (but in Sheepe quite contrarie) [Tab. 16. fig. 2 and 3. ʟ ɴ] and are articulated by *Arthrodia* [Tab. 16. fig. 1. from ʟ to ʳ] with a flat head to a ſhallow cauity in the ſecond griſtle, that the *Shield-griſtle* might be mooued vpward and downward.

The Cauities

On either ſide neere the proceſſes it hath certaine recurued or bowed cauities. The vpper of which being in the middeſt [Tab. 16. fig. 2 and 3. °] is the leſſer, made for the *Epiglottis* to raiſe it vp eaſily and ſuddenly. The lower are on each ſide one [on both ſides at H] whereinto the *anterior* Muſcles are implanted. [Tab. 15. fig. 6. ᶠ] Finally, this *ſhield-griſtle* is mooueable, partly by articulation, partly by Flexion. The Articulation may be called *Arthrodia*, by which it is drawne length-waies vpward and downeward, and theſe ioynts are at the lower proceſſes which are ioyned to the ſecond griſtle, the draught is made by the firſt and ſecond paire of the common Muſcles. It is alſo drawne in length without a Muſcle being compreſſed by the 3 paire and looſened by the flexible ſubſtance of the griſtle. It is alſo mouable by flexion, for becauſe it is thin it is alſo flexible, whence

it

it ſtretcheth in breadth, it yeeldeth downeward and againe returneth vpward, and ſo the cauity of the *Larynx* is lifted vp and depreſſed, ſtraightned and relaxed.

The vſe of this griſtle is foure-fould, the firſt to make the cauity of the *Larynx*, the ſecond to eſtabliſh the *glottis* or whiſtle, the third to affoord an implantation or ſeate of reſt for the muſcles. And finally, to faſhion out the articulations neceſſarily required in the motion of the Throttle. The vſe of the Shield-griſtle.

The ſecond and lower griſtle is called κρικοειδὴς, the Ring-griſtle, [Table 16 fig. 4. and 5. and 6.] for ſo *Galen* and *Oribaſius* his *Epitomizer* call it becauſe it is like a Ring: and indeed it is very like that bony ring which the Turkes weare vpon their right thumbes when they ſhoot, that they may drawe the bow ſtring with greater ſtrength. It is commonly called *Innominata*, the Griſtle without a name, becauſe the Antients before *Galen* gaue it no name. the reaſon hee giues *de diſſectione muſculorum*, becauſe they coulde liken it to nothing in the whole world; haply ſaith *Bauhine* becauſe the actions of the *Larynx* are performed by motion, now the other three doe moue, but this being as it were the Baſis and foũdation of the reſt is altogether immouable. The ſecond griſtle. Why cald *innominata*

It lyeth vnder the *Shield-griſtle* and is the Baſis of the other griſtles which it ſuſtaineth. It lyeth vpon the firſt griſtle of the Rough arterie to which it is ioyned by a Ligament; and the greateſt part of it is in the backpart of the *Larynx*, yet it compaſſeth it round about like a ring eſtabliſhing it by his hardnes. And it was very neceſſary it ſhould be like a Ring or perfect Circle, partly that the pipe might be alwaies open, and ſo way made for the ingreſſe & egreſſe of the Ayre, otherwiſe in the motion of the *Larynx* the ſemicircular griſtles of the weazon would haue beene compreſſed: partly leaſt when the Gullet is dilated or ſtretched by the ſwallowing of an hard and thicke ſubſtance, the pipe or weazon which is the way of the breath ſhould be compreſſed, whence ſuffocation or ſtrangling muſt needs follow. On the outſide and foreſide it is gibbous, narrowe, ſlender and round like the other griſtles of the weazon. [Table 16. figu. 4. and 5. R] Gibbous the better to defend it ſelfe, to helpe the ſhield-griſtle to make the cauity, to help the ſound and to dulcifie it. Thinner that it might not hinder the ayre that was to bee driuen into the ſhield-griſtle; for if it had in this place beene broader, then had the ſhield-griſtle wanted place to moue it ſelfe in. But behinde where it doth not compaſſe the ſhield-griſtle it was fitte it ſhould bee broader, and ſo well might be; [Table. 16. figu. 4. 5. and 6. S] broad I ſay like the head of a ring whereon the ſeale is grauen, and flat: otherwiſe the roundneſſe of it together with the hardneſſe would haue hindred the ſwallow. The ſituation And reaſon thereof. The figure.

Moreouer it is alſo thicker, eſpecially towards the vpper part, and that becauſe of the articulation; and that the ſlit and the *whiſtle* might bee on euery ſide defended and eſtabliſhed: adde hereto another reaſon why it was thicke, to wit, that from thence ſome muſcles might take their originall. For in the very middeſt which is the broadeſt part there ſtandeth vp a rough lyne [Table 16. fig. 6. T] which *Galen* in the 7. chapter of his booke *de diſſectione vocal. Inſtrum.* calleth the *Spine or the ridge of the Griſtle without a name.* By this lyne is made a ſhallow cauity on each ſide [Table 16. fig. 5. V X] wherein the ſecond payre of proper Muſcles are commodiouſly ſituated. But in the vpper and backward part it hath on each ſide a long knub [Tab 16. fig. 6. Y Z] or if you had rather call them bunching proceſſes (*Galen* calleth them *Shoulders*) with which the Ewre-griſtle [Ta. 16. fig. 9. e] is articulated; in which place it is alwaies harder and thicker; ſo that that which ſeemed in childhood griſtly in the middle or growne age becommeth or at leaſt ſeemeth to bee bony. In the middeſt it alſo ſwelleth a little on both hands and becommeth thicker [Table 16. figu. 6. N O] and excauated, in which cauity the lower proceſſes of the Shield-griſtle whoſe heades are flatted, are ſtrongly ioyned to this Ring griſtle by a plaine articulation. Finally, in the lower part [tab 16. fig. 4. 5. 6. S] there runneth downward a kinde of proceſſe, from whence the third paire of proper muſcles do ariſe. The ſubſtãce.

This Ring griſtle by how much it is leſſer then the Shield-griſtle, by ſo much it is greater then the Ewre-griſtle: it is alſo ſomewhat narrower then the lower Baſis of the wezon, wherfore the lower part of the *Larynx* is larger then the vpper *orifice* which is in the chops. It is the hardeſt and the thickeſt of all the reſt (although it be not all of an equall thicknes) becauſe the others reſt vpon this as vpon a Baſis; wherefore alſo it is immouable that vpon this the other griſtles might be both mooued and articulated, and the muſcles which belong vnto the others herein alſo firmed and eſtabliſhed. The quantity.

It is tyed to the Shield-griſtle by the help of membranes or tyes produced from the firſt The connexion.

to the second; these ties are double, as also are those which couple the second with the third as *Galen* teacheth in his booke *de voce & anhelitu*, and these membranes doe inuest not only the middle part of this Ring-gristle but also the whole basis of this shield-gristle.

The third gristle. It is indeed double.

The third Gristle of the Larinx is in the sides [Tab. 16 fig. 7.8.9.] and is called ἐφυδρεῖον that is, the *Ewre*, because it is like an Ewre out of which water is poured if you marke the two vpper processes couered yet with their Membrane; or because it is like the spout of a wine pot. This is commonly esteemed and receyued for one gristle, because they are not wholly separated, and perform their action together not a sunder. VVhilst it is yet couered with his coate it is like an imperfect Triangle: but if you take of the membranes wherewith it is couered, you shall perceiue that it is made of two gristles [Tab. 16. fig. 7.8. 9. βγ.] which aboue and belowe, are loosely ioyned by the mediation of ligaments and of

Table 16. Figure 1. Sheweth the whole Larynx composed of his gristles with the bone Hyois, *and a part of the weazon or pipe.*

Fig. 2. and 3. Sheweth the Sheild-gristle.

But 4. 5. and 6. Figures shew the Ring-gristle or that which is without name.

Fig. 7. 8. and 9. Sheweth the Ewre-gristle. The 10. the Epiglottis, the 16. sheweth the gristles of the weazon.

TABLE XVI.

A. 1. The bone *hyois.*

B B, 1. His processes.

C. 1. Gristly swellings and membranous ligaments set by course to which the shield-gristle is ioyned by processes.

D, 1, The lateral all shield-gristle.

F, 2. and 3. Sheweth either face of this gristle.

From G, to H, 2. 3. A line in the midst of the first gristle.

I, K. 1, 2, 3, 4. The vpper processes of the shield-gristle articulated to the bone *Hyois.*

L, M. 2, and 3. The inferior processes of the same shield gristle, which in the first figure are articulated to the *crycoides* or Ring-gristle.

N, O. 6 The seat of the *crycoides*, or ring gristle where these processes grow into one.

P, 1, 5, The backe part of the Ring-gristle.

Q, 4, 5. The inside of the Ring-gristle

R, 4, 5. The lower circular region of the Ring-gristle.

S, 4, 5, 6. The hinder part of this circle

T, 5, 6. A hinder line of this gristle.

V, X 6. A bosome on both sides this gristle called also *ventricles.*

Y, Z. 4 5, 6. Two swellings of the ring-gristle which goe into the bosome of the Ewre-gristle.

α. 1, The *Arytenoides* or Ewre-gristle.

βγ 7, 8, 9, Two parts of the ewre gristle

δδ, 8, 9, The empty space of this gristle which is couered with membranes,

εε, 8, 9, The sides of this gristle by which it is ioyned to the ring gristle

ζζ, 8, 9. A processe of this gristle making a little tongue.

η 9, The vpper part of the third gristle like a spoutpot or an Ewre.

θ 10, The basis of the Epiglottis regarding the Larinx continued with the Shield-gristle.

ι 10, The tip of the After-tongue regarding the palate.

κλ 10, The basis and top of the Epiglottis regarding the palate. μν, Both sides of the gristles which make the Pipe of the Rough-Arterie much like the Latine C. ξ 1, The Rough Arterie. π 1, The Membrane which on the backeside, tieth together the gristles of the Weazon.

lation

the membrane that compasseth the Larinx, but in the middest they cleaue asunder or stand separated. In the middest where it is thicker it hath a ioynt wherby it is ioyned to the top of the ring-gristle where it regardeth the Gullet: and because the gristle is double the articulation also is double, which doe on each side receiue into their cauities [Tab. 16. fig. 8. 9. ε ε.] the swelling of the Ring-gristle [Tab. 16. fig. 6. Y. Z.] that so it might the fitter bee straightned and dilated.

The substance of this 3 Gristle differs, from the other two, or being softer, that it might not need the greater Muscles to moue it; it is also slenderer, fatter & moyster that it might not be dryed vp by the ayre, much lesse also then the rest that the passage should not bee angustated or streightned. The substance

It hath processes aboue & below. The vpper [Tab. 16. fig. 7. 8. 9. Z.] which being ioyned do cary the fashion of an Ewre or spout pot, are recurued outward, that they shold not incline inward and so fill vp the cauitie, whereby the free passage of the breath would haue beene interrupted. They are lax, soft, fat and flexible, that they might follow the motion of the whole glottis or whistle. These vpper processes are not altogether separated asunder, least one should haue beene drawne from the other, and therefore in a man they are aboue ioyned with a Membrane; but in Hogs it seemeth to be indeede but one processe. This part is so soft and flexible that when a man vomits it is reclined forward into the Larynx, and soe shutteth the Arterie exquisitely, that no thing might happen to fal downe into the Lungs in our vomiting. The processes vpper.

The lower processes made the *glottis*, or slit, or whistle by which the voyce is tuned. In that part they are wholly diuided [Tab. 16. fig. 7. and 9. ζ ζ.] because it was fit that the slit or *glottis* should be moueable and free. For vnlesse the egresse of the breath bee nartow the voyce cannot be formed. These processes also in the middle of the cauitie of the Larynx are couered ouer with a fat membrane, wherby the slit is made the more firme. This Ewre-gristle is made moueable, because without motion the Larinx cannot bee streightned, and againe dilated; and therefore on either side in the lower end there is a muscle inserted. Lower.

The motion proceeding of the Articulation of the *Ewre-gristle* with the *Ring-gristle* is fourefold. Flexion, Extension, and Motion to both sides; and so it is mooued vpward, downeward to the right hand and to the left. By Flexion the *Ewre-gristle* is driuen into the cauitie by the fourth paire of proper muscles to shut the slit. By extension it is reuelled outward by the second paire of proper muscles to open the slit. Againe, by the motion to the sides they are conioyned by the fifth paire of muscles to constringe it, as by the third paire they are separated to dilate it. The motion of the gristles to what vse they serue.

Now betwixt the Flexion and extension of the *Ewre-gristle* and of the rest, there is this difference, that in the others one motion is made for the behoofe of an other, but in the *Ewre-gristle* both motions are of themselues profitable: the Flexion, to constringe the slit that so the breath might be kept in; and the voyce made at our pleasure, the extension to dilate it againe that the ayre might be plentifully receiued in.

The membranes which tie the gristles together do make certaine bosomes or cauities betwixt the *Ewre* and the *Sheild* gristles, into which, if in eating or drinking any thing fall, be it but a little beare, which often hapeneth when the *Epiglottis* or *ouer-tongue* by laughter or speech when wee are eating is opened, because whatsoeuer it is that passeth against the wind causeth a coughing. Of these bosomes or *sinus*, *Galen* seemes to make mention in the eleuenth chapter of his seuenth booke *de vsu partium*, but since *Galen* (saith *Seuerinus Pinæus*) neuer any man made mention of them but *Gasper Bauhine* our Authour: but whether *Laurentius* had them from him I know not. *Placentinus* hauing got the hint of them, as should seeme from *Bauhine*, hath examined them very diligently in brute beastes, and findes them seldome saue in Swine, Horses and Dogs. *Aquapendens* professeth that he finds them in all creatures vsed to the earth, but in some lesser, in some bigger; yea, so bigge as a man may put his finger downe them: Swine and Horses haue the largest, those of men are not so deepe. The sinus or cauities betwixt the first and third gristles. *Bauhin* first made mention of them.

The vse of these *Sinus* is to alter the attracted ayre that it fall not with violence as the deafe eares of the heart doe. They helpe (saith *Aquapendens*) to retaine the breath when the whole glottis is shut vp. In Dogs these *sinus* are like ventricles. Their vse.

CHAP. XXXV. *Of the Glottis and Cleft of the Larynx.*

The *Glottis.*

THat which is called in Greeke γλῶττις is that body which maketh the Cleft or Fissure in the *Larynx*, which is the chiefe instrument whereby the voyce is formed and vttered. [Table 15. figu. 4. d] It hath the name from the likenesse that is betweene it and the tongue of a flute or other pipe. The Latines all so call it the *Little Tongue*. For as the Sound is made by the Tong of a pipe, so the voyce is made by the Linguet of the *Larynx*, and as a man speaketh by his Tongue, so the pipe is sayde to speake as it were by this *Glottis*; therefore wee call it the *Whistle*.

Situation.

It is situated within for the better generation of the voyce, and becawse the instrument might be freer from outward iniuries.

Figure.

The figure of it is Ouall, sharpned at either side, yet more toward the *Shield-gristle*, then toward the Ewer-gristle. It is as long as the *Larynx*, as well that the gristles thereof might establish it, as also that a man might vary with his voyce high, low, or in a middle key, or as we say Treble, Base or Tenor: adde hereto that being so long it is able to admit a sufficient quantity of ayre. Moreouer as there is but one *Larynx* so there is but one *Whistle*, or cleft which beginneth from the *Ewer-gristle* and endeth into the *Shield-gristle* that so it might be moued with voluntary motion, for wee sayde before that onely these two gristles were mouable, the middle which is the *Ring-gristle* is immouable.

How it is diuided.

Notwithstanding it may be deuided into that which in the vpper part is made especially of the parts of the *Ewer-gristle*, and that which in the lower part is formed of the membrane duplicated. This *Glottis* and cleft runneth in the middle of the *Larynx* directly from the forside backward, that the ayre yssuing out of the cleft and formed into a voyce might instantly touch vpon the top of the Palate and the tip of the Tongue by them to be articulated. And as the slit or cleft of a pipe is sometimes broade and long, sometimes narrow and long or short, so is it in this. For if it be long and broade the voyce is base, if it be narrowe it is treble or shrill: yet the magnitude is proportionable to the body; large bodies haue large slits, and little bodies narrow, from whence comes the differences of Voices.

The composition of it.

The composition of it is very artificiall that the Ayre which is the matter of the Voyce might easile ascend and descend, and might beside receiue a fit repercussion. For it is made of both the processes of the *Ewer-gristle* [Table 16. fig. 7 33.] or of the double Ewer-gristle and a portion of that muscle of the *Shield-gristle* inserted into the processe of the Ewre gristle, which two are inuested with a membrane (making the Inner Cleft, of which we shall speake by & by) which is not only thight to defend it but also moyst which moysture is not only slimy but also fatty: and yet this *Glottis* is moystned with a proper moysture of it own, least our voyce should soone faile in discourse or other vse of it, if the *glottis* and the parts belonging to the *Larynx* should be exiccated. For being of a membranous substance, the frequent motion thereof in our speech or vocifiration, the perpetuall ingresse of ayre and egresse of the breath which is hot, might haue dryed it if Nature had not prepared a proper moysture to keepe it in Temper: for as we see whistles and pipes doe need euer and anon to be moystned or else they will not sound so well; so if this *Whistle* of the *Larynx* had not had a naturall moysture, the voyce must needs haue fayled, as wee see it doeth in those that are sicke of burning Agues, or trauell in hot weather, who cannot speake before they haue moystned their throttles, or if they speake their voyce is stridulous or whining, which kind *Hippocrates* calleth *voces clangosas* in *Prorrhet.*

How moystned.

Vox clangosa.

This moysture makes the surface of the *Glottis* or whistle to be slippery, yet is it beside smooth & glib least the ayre lighting vpon vnequall parts and so yssuing vnequally should make the voyce harsh and vnpleasant. Notwithstanding it was fit this moysture should be moderate, becawse those bodies that are too wette doe sound woorse then those that are dry. VVhence it is that in Rheumes and Murrhes the Voyce is hoarse, becawse the *Larynx* is dewed with too much moysture, but when the moysture thereof is Naturall it maintayneth the Voyce a long time without helpe, the rather becawse as wee sayde the moysture is not thinne that it should soone be spent, but viscid and fatty. And haply this made *Galen* say that the *glottis* was not onely membranous but also fatty and glandulous. The *Glottis* also by this meanes being soft and supple is more easily dilated and contracted, for it was necessary it should open and shutte as might serue best for the different Expiration of the breath.

How the voice becommeth hoarse.

Galen.

For

For the *glottis* is either at reſt or is mooued, when it is at reſt it ſerueth for the inſpiration of ayre; when it is mooued it is the inſtrument of the voyce, for the forming whereof it hath a double motion, one of dilatation another of conſtriction. The dilation is the cauſe of deepe and baſes voyces; the conſtriction is double, either to make the ſlit narrow and then the voyce is treble and ſoft; or altogether to ſhut it vp, whereby the breath is violently reteined with in, as when wee ſtriue to lift great weights, when women are in the pinch of trauell, and in ſuch like violent actions. Wherefore as it is muſculous it maketh the motions of dilation and compreſſion; as it is griſtly it affordeth the ioynts whereon the motion is made, and ſtrength to ſupport the motion that it ſhould not bee ouerturned by the breath; as it is membranous it is more fit to be dilated and conſtringed, the ſlit is formed the better and the muſcle is defended.

The reſt of the Glottis. The motion thereof.

But beſide the ſlit made by the *Ewre-griſtle*, in the inner cauity (and that in man onely) there is formed another ſlit of the concourſe of two membranes. For from the fore and middle part of the *ſhield-griſtle*, the membrane wherewith it is inueſted on the inſide in the middle iuſt againſt the *glottis* becometh double and more ſolid, and attaining ouer to the backeſide of the Larinx is tyed to the inſide of the *Ring-griſtle* not farre from the *Ewre griſtle* that ſo it might be kept ſtretched. Betweene theſe duplicated membranes there remaineth a long cleft running from the backeſide forward [Tab. 16. fig. 7.8.9.] which is made broader when the *ſhield-griſtle* is dilated by the muſcles, and ſo the voyce becometh baſe: as on the other ſide it is treble if it be anguſtated or ſtreightned. And this is holpen by the diuiſion of the *glottis*, for both ſlits are at the ſame time dilated, and at the ſame time conſtringed. *Arantius* maketh mention of this internall ſlit, and is of opinion that it is the chiefe place wherein the voyce is tuned, and that the diuiſion of the *glottis* is but aſſiſtant thereunto.

The inner ſlit

Arantius

The vſe of the *Glottis* is, to be the chiefe inſtrument of the voyce, or principall part in the Larynx which performeth the action, that is, the voyce; for that is the proper action of this inſtrument. For the ayre paſsing is reſtrayned & broken, & ſo produceth the voice neither can any voyce be made vnleſſe the paſſage be ſtraightned (and therefore *Galen* ſaid well, that the Larinx without the *Glottis* cannot frame or forme a voyce, no more then the eye can ſee without the Criſtalline) now it is ſtraightned when it is mooued, that is, when it is dilated or contracted, for it is in our power, ſaith *Galen* in the ninth chapter of his eight booke *de placitis*, to ſhut or open the mouth of the Larinx when wee will, and as wee liſt to cloſe or looſen it, ſo we make our voyce baſe or treble; for if wee let our breath paſſe out lightly and gently, no ſound accompanieth our exſpiration, but if the breath be powred forth ſuddenly and vehemently, then with the expiration there iſſueth a voyce alſo.

The vſe of the Glottis. The chiefe inſtrument of the voyce. *Galen.*

Wee may breath without a voyce.

CHAP. XXXVI. *Of the Epiglottis or Aftertongue, and his Muſcles.*

THat which the Grecians call ἐπιγλωττὶς becauſe it is ſet aboue the *glottis* or whiſtle of the Larinx, the Latines cal *minor Lingua* or *Lingula fiſtulæ*, but becauſe the *glottis* is alſo called *Lingula*, we haue rather called it the Aftertong. It is a griſtle and a couer of the cleft of the Larinx made to fall vpon it when we ſwallow, that no thing ſhould ſlip aſide into the weazon [Tab. 17. it is placed betweene the firſt and ſecond figure, but inuerted and was cut away from figure 1. at [a a]. but Tab. 15. fig. 4.5.6.[b].]

Hippocrates calleth it *clauſtrum* the lock or baſpe. What it is.

Ariſtotle in the twelfth chapter of his ſecond booke *de Hiſtoria animalium*, thinketh that all creatures which lay Egges doe want this *Epiglottis*, but doe cloſe exquiſitely or dilate againe the top of the Larinx as they pleaſe to keepe any thing out of their longues without any vſe of ſuch a couer as is neceſſary in other creatures. *Placentinus* addeth that Frogs haue none of it.

It is ſeated betweene the Larinx and the tongue, and if you looke vpon the ſuperficies of the membrane that compaſſeth the tongue which is continuall with this *Epiglottis*, it may be eſteemed to be as it were a part of the tongue: whereupon ſome haue thought that it hath his originall from the roote of the tongue, whereas it is more likely that it ariſes from the *ſhield-griſtle*. For it ariſeth vpward with a large baſis recurued forward from the inward and higher part of the ſhield griſtle, [Tab. 15. fig. 4.*. fig. 5.†] afterward it grows broder a little and a little, and becommeth like a round Arch, but in brute beaſts it is by degrees anguſtated and determineth into a broade and ſharpe edge. In the baſis thereof it is tyed to the ſhield-griſtle, all the reſt of it is looſe and hangs at libertie.

The ſituation Connexion.

The forme. The forme as ſayth *Hippocrates* in his 4. booke *de morbis*, is like the Iuy leaue, for the Baſis is broad and arched forward into a roundneſſe; or it is like a little tongue as *Pliny* and *Celſus* write. *Veſalius* compares it to a triangle. *Columbus* to a litle ſhield curued & ſtraightned toward the edge. *Aquapendens* to a triangle which hath crooked ſides.

The vpper part called the backe which is next vnto the Palate, is a little conuex and buncheth outward, the lower ſide which is next to the cleft or whiſtle is hollow or a little concauous. The bredth of it is not only enough to couer the cleft but to ſpare.

Rigid or ſtiffe. It is alſo of it owne Nature rigid and ſtiffe ſtanding, that the pipe of the rough arterie might remaine open, leaſt the heart ſhould bee ſuffocated; yet is it flexible that it might perfectly ſhut vp the cleft ouer which it is diſpoſed: beſide, if it had not beene flexible the waight of the meat and drinke would not haue depreſſed it in the ſwallowing: againe, if it had not beene ſtiffe and rigid, when it is once borne downe vpon the cleft in the ſwallowing of meate, it woulde not haue ſtarted vp againe to giue way for the yſſue of the breath.

Yet ſoft too. Wherefore the ſubſtance of it is griſtly and thinne, ſomwhat ſofter then the other griſtles, yet ſo, that it is ſofter, thinner and more flexible on that ſide that reſpecteth the Palate, eſpecially in the very end neare the gullet it is very ſoft, and couered with a fatte membrane. For when the creature breatheth it is lift vp of it own accord to make way for the ayre, but when hee ſwalloweth it coucheth vppon the *Larynx* leaſt the meate ſhoulde fall into the Lungs.

The reaſon thereof. For that which is ſwallowed (as *Galen* well hath written in the 16. chapter of his ſeuenth booke *de vſu partium*) falleth firſt vppon the rootes of this After-tongue, after it is carried vpon the backe of it which maketh it to couch or incline. Theſe motions this *Epiglottis* could not haue had if it had bin either mẽbranous or fleſhy, becauſe it would haue alwayes lien depreſſed, or being once depreſſed it would hardly haue been rayſed vp againe, neuer erected vp right. Neither could it haue beene bony, for then it would alwayes haue bin rigid, neither could it haue bin depreſſed with the ſwallowing of meats and drinks. Wherfore with *Galen* we think that the motion of the *Epiglottis* or After-tongue in a man is Naturall, and that the cleft is couered and againe vncouered, not by the helpe of muſcles but by the waight of thoſe things which we eat and drinke.

The motion of it in men Natural.

Inſome beaſts voluntary. But in beaſtes that chew the Cud there are ſome muſcles found, as wee ſhall ſay in the Hiſtory of the Muſcles & ſhew them ſomewhat particularly, becauſe it is an ordinary thing for young practitioners in Anatomy, to exerciſe themſelues in diſſecting of the Throttles of Oxen and ſuch like: But in the meane time we muſt remember that the *Epiglottis* is couered ouer with a fat membrane much like to the nature of a ligament, which at the ſhield griſtle is full of fat.

The vſe of the *Epiglottis*. The vſe of the *Epiglottis* is to couer the *Glottis* or whiſtle when we ſwallow our meate; for if at vnawares any of the meate do ſlip into the wezon, we preſently keake and are near ſtrangling till by coughing it be gotten vp again, the reaſon is, becauſe that which deſcendeth taketh away Reſpiration. So *Anacreon* the Poet was ſtrãgled with the ſtone of a Reyſon. And *Fabius* the Senator drinking a cup of Milke was choaked with a haire that was therein.

Alexander Benedictus tels of a woman who would haue giuen her Sonne a Pill and was conſtrayned to thruſt it downe his throate with her finger, ſhe thruſt it into his wezon and hee died inſtantly. Becauſe therefore a man cannot liue without Reſpiration, when that Reſpiration is interrupted Nature rowſeth vp her ſelfe to make reſiſtance, and ſo we ſtraine at the leaſt crumme that fals the wrong way. Yet we muſt not imagine that the cleft is ſo exquiſitly cloſed but that ſome part of the drinke ſlippeth into the rough artery, gliding downe by the ſide of the *Glottis* though it be not felt. And this way we thinke diſtilations doe yſſue out of the head into the Lungs, which though they bee very aboundant yet hee that is ſicke cannot feele them, eſpecially in ſleepe they gather very faſt together. Howe *Hippocrates* proued that a part of the drinke is conuayed vnto the Lungs, wee haue before ſhewed by the cutting of a Hogs throate inſtantly after he hath drunk water coloured with Vermilion or any ſuch like, for you ſhall finde the very colour in his weazon. Againe, if ſome of the drinke did not ſlip downe by the ſides of the rough Artery, it were in vaine to preſcribe Ecclegmes, Syrups or Lozenges in affects of the Cheſt. But we finde by experience that all theſe doe helpe expectoration and make the ſpittle come vp more roundly, if they be taken by little and little the head reclined backeward, licked off a knife, a Liquerize ſtick or ſuch like, or if the Lozenges be conteyned in the mouth til they melt of themſelues and

Part of the drink gets into the wezon.

An inſtance.

The vſe of pectoral medicines.

Table 17. *Figure* 1. *and* 2. *ſheweth the tongue cut from the bodie, and the Muſcles thereof. In the firſt the right ſide of it, & in the ſecond his Muſcles ſomewhat vncouered.*

Figure 3. *ſteweth the bodie of the Tongue diuided according to the length of it and his Ligament.*

TABVLA. XVII.

FIG. I.

FIG. III.

FIG II.

Tab. 17. *figure* 1. *ſheweth the Larynx, hauing the Shielde Griſtle cut into two parts, but one part of it together with the* Epiglottis *is inuerted as by the Letters may be perceiued.*

Figure 2. *exhibiteth the Larynx ſhewing the* Glottis.

FIG. II.

FIG. I.

AAA. The Tongue inueſted with a Coate common to the mouth.

BB. A portion of the coat compaſſing the mouth cut frō the mouth according to the ſides of the lower iaw.

C A part of the ſame coat cut from the inner part of the Palat together with the tongue.

D. The Muſcles caled *Baſi-Gloſsi*, according to *Veſalius* the firſt, but in our account the fourth, or the ſixt of the bone *Hyois* according to *Falopius*.

E. The Muſcles cald *Ceratogloſsi*, or the ſecond Muſcle according to *Veſalius*, and in our account the fifte.

F. The Muſcles called *Styloglossi* or the third Muſcle.

G. The Muſcles called *Myloglossi*, or the fourth Muſcle according to *Veſalius*.

H. The fleſh conſiſting of the Glādules, or the ninth Muſcle of the Tongue according to *Veſalius*.

II. The Ligament of the Tongue.

KK, LL. The Muſculous ſubſtance of the tongue, & the fibres thereof.

The Second Figure.

a 1. The *Shield-griſtle* Diſſected.

b 1. The *Epiglottis* or After-tongue.

c, c. The *Arytænoides* or the Ewre-griſtle.

1, 2. The *glottis* or ſmall cleft of the Throttle.

ee, 1. The internall Muſcle forming this cleft or the internall Shield-griſtle.

f. 2. The opening Muſcle of the latter *Crycoarythænoides*.

g. 2. The tranſuerſe Muſcle of the *Arytænoydes*.

and paſſe inſenſiblie into the Larynx. And heerein we imitate *Galen* in the ſeuenth chapter of the fourth Booke of his method, where being to cure one that had an Vlcer on the inſide of the Rough Arterie, cauſed the Patient to lye vpon his backe, and a moyſt Medicine that was fit for the Vlcer to bee giuen and to be held in the mouth as long as hee could, and to relax and remit the Muſcles of the place, for ſo ſaith *Galen* by little and little ſome of the Medicine wil diſtil into the Arterie.

Why wee cough when anie thing fals into the weazon.

But the reaſon why water or drinke when it falleth into the Weazon cauſeth a cough is, becauſe as *Hippocrates* ſaith it maketh a diſturbance for that it oppoſeth the Reſpiration. For the Liquor that falleth downe by the ſides of the Arterie, doth not withſtand the egreſſe of the aer, rather it furthereth it by making the way moyſt & ſlippery. Hence we may ſee how ignorant the Ancients were in Anatomy, as *Plato*, *Philiſtones*, *Dioxippus*, and ſuch like, who conceiued that the drinke went into the Arterie or Weazon, and ſo into the Lungs, and the meate through the gullet into the ſtomacke. Againſt this opinion *Hippocrates* diſputeth in his fourth Booke *De Morbis*, that is, againſt thoſe that think

the

the drinke falleth into the Lunges, yet hee doth not denie but ſome drinke ſipeth that way as we haue ſaide before. Wherefore (ſaith *Galen* in the ninth Chapter of his eight booke *De Placitis*) if *Plato* thought that all the drinke was conueyed into the Lunges he cannot be excuſed becauſe his ignorance is euen palpable: but if he thinke that a part of the drinke is deriued into them he is not altogether deceiued.

Ariſtotle. The like we may ſay of *Ariſtotle*, who thought it an error to ſay that the drinke paſſed into the Arterie becauſe there is no thorough paſſage for it, as there is out of the Stomacke into the draught. For verily if that be auouched of all the drinke it is a verie abſurd conceite: but if it be meant of a little it ſeemeth to be true.

Another vſe. Another vſe of the *Epiglottis* or After-tongue is to ſtrike the aer which ariſeth from the Lungs into a tuneableneſſe, eſpecially if it ariſe with a force or impetuous violence thereunto. And this vſe we haue out of *Laurentius*.

CHAP. XXXVII. *Of the Membrane of the Larynx or Throttle which is the Ligament thereof.*

The mẽbrane of the Larynx THE Larynx is bound about with a Membrane which is common with the Membrane of the mouth, to be a defence to it both outwardlie and inwardly, and whereby the aire being gently and eaſily ſtrucken, might make the voice pleaſant and moderate. Firſt inwardly, the whole cauitie is compaſſed & ſo it is led ouerthwartly to the vpper part of the Larynx, being diuided in the middeſt of his length it maketh a little cleft. But outwardly it doth partly encompaſſe the external ſuperficies, and partly it inueſteth inwardly the Griſtles and Muſcles.

Why the membranes of the Larynx are moyſt. They are ſteeped in a certaine ſlimie humidity, partly leaſt the Reſpiration being warme, ſmoky and drie, ſhould make the parts drie alſo, partly that the *Epiglottis* might be cloſely ioyned to the *glottis* and ſo his exccation might bee hindred, which humidity is more aboundant within, yet ſo that in thoſe which are ſound it is neither more copious nor more ſcarſe then the inſtrument of the voice doth require; by it alſo it is poliſhed and ſo the voice is made pleaſant and equal, for being moiſtened with a kinde of humidity it doth familiarly beate the aire, whence the ſweeteneſſe of the voice proceedeth. This may be prooued by the example of Muſitians, who going about to ſounde longer Pipes or Trumpets whether they be of Braſſe or wood, will ſomewhat moyſten them (haply with their Spittle) whereby the voice may bee made more delectable, elſe becauſe of too much ſiccitie the ſounde is not onely vnpleaſant and harſh, but is made with more difficultie and labour; like as if it be too moyſt the ſound is obtuſe, wherefore we ſaide before the voice is made hoarſe by the humours which come out of the Braine into the Choppes.

Whence a pleaſant voice proceedeth.

Why they are craſſe & thick. Theſe Membranes of the Larynx are for the moſt part thicker and ſtronger then all the reſt. The outward is verie craſſe and laxe and as it were rough and rugous; for aboue the *Epiglottis* it is lax and craſſe, where it is bound to the ſides of the third griſtle, and betwixt it and the griſtle, eſpecially at the baſis, there is a little Fat growing. It is lax, that it may more eaſily be incurued and turned vpon the Larynx and be mooued in deglutition or ſwallowing, in an acute and graue voice vpward and downward. And it is craſſe, ſomewhat hard alſo and denſe, becauſe by that way meate ſometimes halfe chewed, hard and in great gobbits muſt paſſe of neceſsity.

Why they are laxe.

Some there be which thinke that this Membrane is increaſed with fleſhy fibres, and that it becommeth a muſculous membrane both in men and beaſts to help the lifting vp of the Epiglottis, which Fibres are compaſſed with a little skin both outward and aboue, leaſt it ſhould be hurt in the paſſage of the meate.

The Inner coate. The internal Coate or Membrane which is more craſſe in the cauitie of the Larynx or Throttle then it is in the pipe of the Artery, is ſoft, ſtretched and ſlipperie, beecauſe the cauitie was to be made poliſhed and ſmooth; but where the cleft of the Larynx doth cloſe, this Membrane on both ſides is by often compreſsing of it when wee holde our breath, made more hard and callous, and with the ſubſtance doth change the colour & waxeth more white. But of this Membrane we haue ſpoken ſomwhat before in our Hiſtory of the Rough Artery. Concerning the veſſels alſo and the Glandules of the Larynx we ſhall ſpeake in their proper places.

CHAP

CHAP. XXXVIII. *Of the sound and the voyce.*

IT is sufficiently manifest by that which we haue said, that the voyce is an action of the Larinx, and that it is the instrument of the voyce, and that the *glottis* or whistle is the first and immediate cause of the voyce and this is *Galens* opinion, wherefore we will discourse a little of the voyce. How a voice is made.

The voyce therefore according to *Aristotle* is a certaine significatiue sound of a liuing creature, or as *Galen* defines it, the voyce is the Ayre stricken, and a sound is the percussion of one body against another *in* some other. There be therefore three things required to the effecting of a sound, to wit, two seuerall bodyes which doe mutually strike one another, & the ayre in which the purcussion is made, which ayre is beaten and broken betwixt the two bodies. The definitiō of a voyce.

But that these bodyes thus mutually knocking one another, may effect a sound, first, it is required that they be stretched, by which tension or stretching they are somewhat hardened, therefore *Aristotle* supposed that they ought to be hard, for a sponge & wooll may mutually strike one another and yet no sound be made. But if you say that sounds are oftener made by hard bodyes, yet it is true also that sometimes they are made by soft bodyes, for if you ioyne your lips together a kind of whistling may be heard, but this proceedeth from their tension whereby they thrust out the Ayre by compressing each other. What things are required to a sound. The bodyes must be hard.

Moreouer, they ought to haue a broade and plaine superficies, for two needles striking one another doe make no sound. Againe, the percussion ought to be vehement and quicke, for if you gently put your hand to any thing no sound is heard. But if besides, these bodyes be polished and concauous or hollow, and of a solid and ayry matter, such as brasse and glasse is, then the sound will be greater, more plaine and delightsome, which may bee shewed in bels and musical instruments for such bodyes containe a great deale of ayre in them, which airy when it is moued and seeketh a vent, doth euery way strike about the sides and euery way causeth a resonance or resounding. Broade and plaine. And polished for the better sound.

Now seeing a voyce is the sound of a liuing creature, or a certaine species or kind of sound; there must be euen so many things required to it as a sound. Namely the aire for the matter, the bodyes which by compressing the ayre doe as it were breake it for the efficient cause; & we may adde the place which is the head of the rough Arterie. What is required to a voyce.

The ayre which is required for the forming of a voyce is that which we returne by expiration, and this is the matter for the generating of a voyce; for that which is inspired is prepared for the refreshing and nourishment of the heart and Inbred heate. Wherefore a mans voce is so long continued as the expiration endureth, and when it fayleth the voyce vtterly ceaseth. Now this expired aire is broken by by the ayry instrument and so the voyce is formed at this breaking, and where it is broken there percusion doth forthwith follow. But it may be demanded which of the ayry instruments can strike and presse this ayre. The ayre expired.

The Chest and the lungs do not make this voyce, because their motions be *Diastole* and *Systole* or dilatation and constriction which make no voyce. Neither is it the pipe of the Rough Arterie or the greatest part of the weazon because it wanteth muscles: wherefore it cannot perfect the voyce which is a voluntary worke. By which of the spirituall instruments the ayre is broken?

Moreouer, if you cut the weazon below the Larinx or head, the creature will yet expire freely, but he will not vtter any voyce: and if againe you bind this incision the voyce will returne. Neither is it the nosthrils which is the cause of the voyce, because they are onely passage; nor the mouth because it is onely a receptacle, nor the tong because they which be dumbe haue their tongs and respiration sound; so they which haue their tongue cut out doe yet vtter some kind of voyce. It remaineth therfore that amongst the ayry instruments onely the Larinx or throtle is it which is as it were, the shop or worke-house wherein the percusion is made, which the fabricke and structure of it do sufficiently shew. It is broken by the throtle and why.

For it hath Muscles which are necessarily required to the effecting of a voyce which is a voluntary action: It hath also nerues which affoord the motion, Gristles also which are hard bodyes, broade, smooth, polished and concauous or hollow, vpon which the ayre may easily be broken, constringed and compressed and therwithall resound. It hath also a cleft which is requisite vnto the breaking of the ayre that so a sound may be made. For this breaking of the ayre cannot be done vnles it passe through by some straight & narrow way This Elision or breaking is made through the cleft when it is constringed and angustated or straightned by the articulation of the *Arytænoides* or Ewre-gristle and the Muscles. How this aire is broken.

Wherefore

Wherefore *Galen* writeth that a voice cannot be made vnleſſe the paſſage be ſtraite, neyther can that paſſage be well called ſtraight, vnleſſe it tendeth by little and little from a large paſſage vnto a ſtraighter and is againe amplified or enlarged from that ſtraightnes. After this breaking doth a percuſsion preſently follow, either againſt the aire or againſt a ſolid bodie, and therefore *Galen* ſuppoſeth that the *Vuula* is like the quill of a Citterne in the forming of the voyce, becauſe the aer being blown out is forced againſt the *Vuula*.

Vehement impuſiō of the aire is required vnto the ſound.

But not onely the ſtraitneſſe of the cleft is neceſſary vnto the voice that the paſſage of the aire be narrow, but alſo the vehement impulſion of the breath, ſo that it ſuddainlie and at once breake forth: for when either of theſe faile the voice cannot be made; which ſudden and vehement expiration *Galen* calleth ἐκφύσησιν or efflation. The other cauſe therefore of the Voice is efflation without which it cannot be made though there maie be efflation without any voice.

How exſufflation is made.

This exſufflation or ſtrong breathing out is made by the Muſcles, binding the Cheſt & the *Abdomen* or panch, by which conſtriction the Lungs are depreſſed and conſtringed, the Midriffe is incurued towards the cauity of the Cheſt, whereby his cauity is made ſtraiter and the breath carried vpward out of the Lunges thorough the rough Artery, (wherefore *Galen* ſaide, that the voice was prepared in the Rough Arterie when the aire being ſhut vp and compreſſed there, doth after a ſort attaine the ſtate and condition of a ſolid bodie before it yſſue through the cleft) and beeing extruded or thruſt out with violence and force through the ſtraite cleft, yeeldeth that ſound which we call a Voice.

The vſe of the voice.

Galen expreſſeth the vſe of the Voice in theſe wordes, that it is the Meſſenger of the Thought of the mind, and therefore worthily is accounted the principall of all the actions of the Soule.

And thus are we arriued at the end of this Booke of the Senſes wherein we haue omitted the Senſe of Touching becauſe it is already handled in the ſecond Booke. Now we come vnto the Controuerſies.

¶ A Dilucidation or Expoſition of the Controuerſies belongnig to the Senſes *and their Inſtruments, as alſo of the Voyce.*

Placentinus his Præface.

Of the Excellency of the Senſes.

The contemplation of our ſelues dooth further vs in the knowledg of God.

When I compare Diuine things with Humane and in like maner Humane with Diuine, and with a through examination do diligentlie view the properties of them both; I can finde no man ſo nere a kin to the myſticall Nature of God, as thoſe which make good vſe of that Oracle of *Apolle*, γνῶθι σεαυτόν, *Know thy Selfe*. For ſeeing that admirable Architector and Maker of all things did make the bodie of man according to his owne Image, it cannot be but he which is well skilled in the Fabricke and VVorkemanſhippe of himſelfe, vnto him I ſay will the Nature of the Creatour and Arche-tipe more plainely appeare, becauſe hee which is well read in his owne body, ſhall ſee in all euen the leaſt operations of his minde or actions of his bodie a liuely Impreſsion and infallible markes of Diuinity. And hence it was that they which vſed no diligence to prye into the ſtructure of their owne bodies, were worthily reproached by the Ancient with the ignomious Title of *Epicurean* Hogges. for ſuch men beeing enſnared with the allurements of their Senſes, were onely carried thither,

thither whether they like Beasts they were transported by the force & rage of their Senses measuring the chiefe felicity of man by the narrow scantling of the soule,& naked pleasure of the body. But *Ouid* doth manifestly shew how farre a man differs from a beast where he singeth.

Pronaq; cum spectant animalia cætera terram,
Os homini sublime dedit cœlumque tueri
Iussit, et erectos ad sydera tollere vultus.
VVhen other creatures on the earth doe pore,
Nature gaue man a high erected looke:
The heauens to view, and Dieties to adore,
And reade the Characters in that faire Booke.

Why beasts looke downe, and men vpward.

Surely a hidden mysterie of a Poet, and words truly beseeming a man, wherein hee would beate vpon nothing but this, that man being mindfull of his diuine originall, may by the contemplation of himselfe ascend higher into the mysticall knowledge of his diuine Creator. Seeing therefore it is a matter of so great moment to know our selues: It seemed to me not onely commodious,but of absolute necessity to compose some small Treatise (though a taske of hard labour) wherein as in a most cleare glasse a man may take view of himselfe,and see his owne nature as it were deciphered with *Apelles* Pencil.VVherefore I will here exhibite both the essentiall parts of man, to wit, his Matter and Forme, together with their functions and proprieties, as well particular as common,obseruing the order of Nature, because wee cannot come perfectly vnto the knowledge of man, vnlesse first wee doe well see into the Essence both of the body and the soule. Now the knowledge of the soule cannot be made manifest but onely by her operations,which also seeing she doth not performe without the helpe of corporall organs,there is a necessity imposed, that wee also vnderstand the exact composition of the body. But because in the deliuerie of the method of Arts we ought alwayes to proceede from vniuersals and such as are better knowne vnto vs,vnto particulars, and that the faculty of sensation is as it were an vniuersall thing,as being dispersed through the whole Systeme and frame of the body,the order of Nature requireth that I treate of it in the first place.

Why he first treateth of the Senses.

Moreouer,amongst all the offices of the soule this faculty of sensation seemeth to challege the chiefe place, neither that faculty only which is lodged within and receiueth the images of things, and after deliberation or discourse doth iudge of them; but much more that whole sett of senses which doe outwardly *perceiue* all sensible obiects, and perceiued, doe carie them to the Tribunall of the Internall sense and doe so enforme it, that it is able to pronounce a true iudgement concerning them. For without these externall senses, wee must needes acknowledge the Internall imperfect and vnprofitable. For if wee conceiue any thing in our minds,& nourish that conceit by discourse,againe and againe ventilating it to and fro, wee shall obserue that all things had their originall from the outward senses; for neither could colours, odours, nor sauours be knowne, neither could the Internall sense discourse of sounds, or of any Tactile qualities without the message as it were, and information of the outward senses, by which the Images of thinges are imprinted in it. And with this doth that Philosophicall axiome agree. *Nihil est in intellectu quod non prius fuerit in sensu.* Nothing is in the vnderstanding which was not before in the sense. The Prince of Philosophers esteemeth this the fountaine of all Artes and Sciences. And surely if any man setting aside the assurance and the authority of senses,shall seek for the grounds and *euidences* of Arts and other Obiects else-where then from the senses, hee shall not onely entertaine into his minde a dissolute and vaine confusion,tossed hither and thither without any stedfastnesse, but also calling in question the most sure foundations of Nature, shall cast himselfe headlong into a dungeonof perpetuall and intricate obscurity.

All Arts haue their beginning from Sense.

Quid referemus enim quod nobis certius ipsis
Sensibus esse potest; quo vera et falsa notamus.
For what more certaine euidence of things can be obtayned,
Then that which true or false we iudge by outward sense vnstayned.

VVhence shall hee haue the grounds of Demonstration which endeauoureth to derogate from the credit which is due vnto the senses,which are the foundations of al Sciences?

For

Demõstration from Sense.

For Demonstration is from vniuersall things, and such vniuersals doe arise and spring out of singulars: but the externall senses doe *perceiue* all singular things. Now there is none so ignorant which doth not see what will follow hence. The same thing *Lucretius* confirmes in these verses.

Inuenies primis a sensibus esse creatam
Notitiam veri, nec sensus posse refelli,
Qui nisi sunt veri, ratio quoq; falsa sit omnis.
The knowledge of all truth who seekes, must hold
From outward senses first to haue proceeded
Those Demonstrations cannot be controld,
Or could they, Reasons selfe should be deceiued.

Hence it is, saith *Aristotle*, that such men are vnfit for some Arts and Sciences, to whom Nature hath from their birth denied any of these senses.

VVhosoeuer therefore doth not content himselfe with the infallible credit of the senses, is worthy with *Anaxagoras*, who called into question the whitenesse of the snow, as *Aristotle* remembreth of him, to be giuen ouer vnto the doubtfull and suspended vncertainty of the *Pirrhonij* or Scepticks, & to waite till the things themselues shall tell him what their seuerall natures are. But we in the mean time admiring this maiestie & certainty of the senses, will make entrance into so faire & pleasant a field of discourse, and handle euery one of them in particular, beginning with the sense of Touching, which as it is more common then the rest, so without doubt deserues the first place: For this is the ground of all the rest, and doth consist in the εὐκρασία, or moderation and temperament of the foure Primarie qualities. And hence it was that *Aristotle*, and with him all other Philosophers haue iudged this sense woorthy that honour to bee called κατ' ἐξοχήν or by a certaine eminencie or excellencie without adding thereto any Epithite *The Sense*, as if they should haue said the onely Sense of all Senses. And that not vnworthily; seeing (as the same *Aristotle* affirmeth) euery sense is a kinde of Touching, as whereof the whole company and set of the other Senses doe stand in neede for the better perception of their obiects. As for example. The Taste neuer should discerne of sapours except the gustible matter were touched by the spongie body or pulpe of the Tongue; neither could the Organ of smelling receiue any odours vnlesse the perfume of odoriferous things should touch the same. The same are we to thinke of the other Senses, to which in like manner is required, though not a Mathematicall yet a Physicall Touching: what neede we adde more? It is the Sense of Touching, which perfecteth the operations of all the other Senses, and yet it selfe needeth not the helpe of any. Yet this I adde moreouer, that this sense is capable of the Nature of many more contraries then the other Senses, for it iudgeth of Heate and Colde, Moyst and Dry, Soft and Hard, Light and Heauy, Slender and Grosse, Rare and Dense, Smooth and Rough, and an infinite number of that kinde. On the contrary, the Sight doth perceiue nothing but white and blacke; for Red, Yellow, Skycoloured, and other such like, are not contrary but intermediate colours, and so of the rest: that I may also lightly passe by this, that al other Senses are restrained within some small organ about the brayne, but the Touching is diffused through the whole body. These arguments doe sufficiently commend the preheminence of this sense of Touching. Yet if you please to attend, and more accurately consider these which follow, you shall see the maiestie thereof to shine more plainely vnto you. For first, it is by the benefit of Touching that we are conceiued and formed in the fertile Garden of our Mothers wombe. For our wise and prouident Nature ayming at Eternity, hath endued the partes of generation with a most exquisite sense of Touching, for the conseruation of the Species or kindes of creatures, so that the creatures beeing rauished with an incredible kinde of pleasure, doe more readily apply themselues to venereall embracements, (otherwise a thing filthy and abhominable) and endeauour the procreation of their owne kindes. VVhen the Infant in the wombe yet liueth onely a vegetatiue life, hee is first of all endued with the sense of Touching; whereby hee is cherished, nourished, and encreased, and is at length perfected; for so long as he is in the prison of the wombe, hee neither seeth, nor heareth, nor smelleth, nor tasteth any thing, but yet hath absolute necessity of the sense of Touching, that he may be able to auoyde imminent dangers.

The dignity of the sense of Touching.

No sense without Touching.

Conception is by Touch.

The touch doth first exist of all Senses.

Moreouer, this Sense is not only borne together with vs, but also which is more woor-

thy

thy of admiration, when all the other Senſes periſhing euen for the leaſt perturbation of the minde and leauing vsvngarded and proſtituted vnto death, yet this like vnſeparable and faithful *Achates* doth attend vs vnto the laſt breath: whence *Ariſtotle* in the third Book *De Anima*, cha. 13. Text. 67 writeth, *That if any Creature be depriued of this Senſe of touching death will of neceſsity enſue. For neyther is it poſsible, ſayth he, that any creature ſhould want this Senſe, neyther if hee be a creature is it of abſolute neceſsitie that hee haue any Senſe beſides this*, (as if he ſhould ſay) that this Senſe is of the verie eſſence of the creature; and therefore other ſenſible obiects by their immoderate extreames, doe onely corrupt their proper organ, but the exceſsiue qualities of tactile things do take away the life it ſelfe. Againe, things euen without life cannot ſubſiſt without Touching, as *Ariſtotle* ſayeth, who thought that neyther action nor paſsion nor any mixtion can bee without Touch, and therefore neyther can the mixt bodie be without it. For though theſe things without life do draw their nouriſhment out of the earth, yet they do it not indifferentlie and without choice of that which is more or leſſe pleaſant vnto them, if at leaſt this kinde of natural accord may be called a pleaſure, when as indeede they haue not power to ſeparate or diſtinguiſh that which is conuenient from that which is inconuenient.

Touch is of neceſsitie the reſt for commodity.

Plants cānot bee without Touch.

Furthermore, if we will ſtand to *Ariſtotles* determination, that there can no other ſenſe ſubſiſt without Touching, then will it follow that this being taken away no ſenſe can remaine. Now if the Senſes be taken away, the whole family of Arts (which we ſaid before did depend vpon their credit) muſt needs decay, nay you ſhall remooue the Sunne it ſelfe out of the world. If any man doubt of this let him ſeriouſly ſuruey all the Artes both Liberall and Mecanicall.

If you further demaund what vſe this Senſe doth affoord vnto Phyſicke, know that without it this Art would be verie defectiue, yea woulde ſo darken the eyes of Phyſitians, that they ſhall not be able to determine any thing certainly concerning the temperature of their Patients, of their Faculties or ſtrength; but muſt of neceſsity grope vncertainlie in darke and palpable ignorance.

The Vſe of Touching for Phyſick.

If you reſpect Morall Philoſophie, this Senſe will ſtand vs in great ſtead. For perceiuing and feeling the euils which enſue of vices it doth leade and encline vs vnto the way of vertue; yea it cauſeth vs to take pleaſure therein, which pleaſure the Epicures doubted not to account the *Summum bonum*. The like we might ſay of other Artes (which leaſt our Diſcourſe ſhould be without end, we will with ſilence paſſe by, in all which Touching is not without his excellent vſe.

His profite in moral Philoſophie.

To conclude, if it be lawfull to tranſcend from theſe Earthly things vnto Celeſtiall, we will a little conſider what vſe this Touching hath in diuinity. Did not this Senſe reduce S. *Thomas* wandring in by-wayes out of the heauenly light into the true way when he wold try the preſence of our Sauiour by this Senſe, as it were contemning the vſe of the reſt? Did not the woman only by the Touch of the Hemme of Chriſts garment become ſound and cured of her twelue yeares Flux of blood? And do not wee reade that eternall Prince of Phyſitians reſtored ſight vnto the blind onely by the Touch of their eyes? And did hee not heale the woman ſicke of a Feauer by Touching of her? Yea, and that which is beyond all admiration and farre exceedeth the vnderſtanding and capacity of man, did hee not bring again from death vnto life the daughter of *Iairus* by taking her by the hand? And the Sonne of the widdowe ready to bee committed to the Earth onely by Touching the Coffin? O healthfull and ſauing Touch, O ſearching Senſe. But wee holde our handes, both Time & the Matter requires that we proſecute the remaining Senſes in as few words as we can.

The profite of Touching in Diuinity.
Luke 17
Luke 18
Math. 9.
Luke 7

After the Senſe of Touching we place the *Taſte* in the ſecond ranke. For beſides, that one kinde of obiect, to wit, Earthy, is by Philoſophers aſsigned as common to them both, it is as wel as the Touch not only commodious (for ſo are the other ſubſequent Senſes) but alſo neceſſarie vnto the conſeruation of the *Indiuiduum*, whence it is that manie commendations of the Touch do not vnfitly agree vnto this Taſte. For ſeeing that Taſte is the chiefe Senſe in diſcerning of Sapors, as all men of vnderſtanding acknowledge & experience it ſelfe confirmeth, it muſt needes followe that by the helpe thereof the bodye is nouriſhed without danger, but when it failes the bodye periſheth and the whole Nature thereof goeth to nothing. For without it we cannot diſcerne of Sapours, nor iudge betwixt hurtfull things and healthfull, neyther betweene that which is pleaſant and vnpleaſant, but become inferiour not onely to brute beaſts but alſo to plants, which do not con-

The praiſe of Taſting.

It is neceſſary for the Conſeruatiō of the *Indiuiduum*.

fusedly and without choyce, attract any Aliment but that which is most agreeable to their Nature, and so conuert it into their owne substance.

But because the sense of Tasting doth participate with the Touch in the perception of sweetnesse and pleasantnesse as in many other things it doth : therefore I suppose the worth or exellency thereof is sufficiently declared in the commendation of the sense of Touching, so that we thinke it vnnecessary to vse any longer discourse thereof.

The prayse of Smelling.

We will now proceede to the sense of Smelling, the organ whereof seeing Nature hath placed in the middle of the other senses, we will therefore ascribe vnto it the middle place of honor betwin the other senses This Sense doth not only receiue the fragrant breath vapouring from odoriferous obiects and abiding in the ayre; but is besides a faithful Taster of meats, it gouernes the mouth lest sometimes at vnawares we should swallow that which is hurtfull and distasting and so pollute the sweete Balsame of our life. And this instinct wee see in Dogs and Apes, who neuer snatch any thing into their mouths before they haue first made tryall thereof with their Nose.

Againe, by the strength of this sense many creatures do hunt out their liuing, and therfore the Kites follow after karkasses; hounds after Hares onely by their sauours: I say nothing of that excellent profit which it affords to the art of physick: for among other predictions in our art that is not the least which is taken from the Sauor of the patients excrements, whereby oftentimes we find out the cause, the kinde and the issue of the disease. Chirurgions also by the sauor or smell of a wound are able to iudge whether it be *Cacoeticũ*, that is, of and ill an vntoward disposition or no. Adde hereto that by the smell wee attaine vnto the knowledg of simples, yea and of compositions, with what faculties and vertues they are endowed. From hence some haue concluded that all oderiferous things are hot and such like propositions.

The nose doth much beautifie the face.

The beauty that is added to the face of man by this organ of smelling (wee meane the Nose) is very great, I will giue you a pregnant instance therof in an example or two worth our remembrance. First, of a yong man who being adiudged to be hanged and the executioner at hand, a certaine maide suborned by his friends and quaintly dressed and set out, goes vnto the Iudges and makes supplication for his life, requiring him for her husband, well; she ouercame the Iudges: This done, the guilty yong man being set at liberty and comming from the gallowes vnto the maide attired and dressed in such costly ornaments, he presently cast his eye vppon her Nose which indeed was very deformed, and instantly cries out that he had rather haue beene hanged then freed vppon condition of vndergoing so deformed a choyce in his Matrimony. To this is that of *Horace* very answerable in *arte Poetica*.

Hunc ego me, siquid componere curem,
Non magis esse velim, quam prauo viuere Naso.
Should I indite, I had as liefe my Nose should stand awry.
As fairely to begin my worke, and patcht vp bungerly.

A History.

It also a very memorable example, (for we may mingle things thus holy with prophane) which we reade in our English Chronicles concerning one *Ebba* an Abbesse in a certaine Nunry, who cut of her own Nose & the Noses of her Nuns, that being so deformed they might auoyd the hateful lust of the Danes; taking it for granted that the Nose was the chief ornament of the face. And hence it was that in antient time, when they would put any man to great disgrace and ignominy, or disappoint them of all hope of attaining to any degree of honour, or the gouernement of a State; they cut off their Eares and Noses. Yea those which had such deformed Noses were neither admitted to any Priestly function nor Imperiall office.

The Nose is necessary to life.

So farre was it from them to account them worthy honour, who were destitute of this honorable Organ. Hence it was that the Prince of Poets, *Virgil* in the 6. of his *Aeneads* doth call the cutting of the Nose, *vulnus inhonestum*, a wound full of shame and reproch. To these we may add that the Nose it necessary for our very life : in so much as Nature hath made it the instrument of Respiration, without which wee cannot liue one moment; for when the lungs needs more ayre then ordinary, wee perceiue the sides of the nosthrills to be moued sometimes not without violence.

But cutting short a whole troope of commendations wee will proceede vnto the Hearing, which no voyce, no not a riuer of eloquence is able to extoll with due prayses, if

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we doe but contemplate the cunning, skill and diligence, which Nature hath vſed in the fabricke of this Organ, & more accurately intend how many winding inuolutions, burrows, holes, ſhels, dennes and darke caues like labyrinths ſhee hath prepared and furniſhed therein. The wonderful worke of the Eare.

I add further, that by the benefit hereof we attaine vnto the knowledge of all kindes of Sciences: in reſpect of which *Tully* doth equallize vs with the Gods. For theſe Arts are not ingrafted in vs by Nature, but to be obtayned otherwhere; for ſaith *Lactantius*, it is the propertie of God and not of man to haue *proper knowledge*, that is, ariſing out of himſelfe. For this cauſe Nature hath by a diuine skill, made the eares open, that we might alwayes heare when learned men ſhould teach & diſcourſe learnedly, and lay vp in the Regiſter of our minds that which we haue heard. And hence it was that *Conſtantinus* called Hearing the *doore of the minde*, becauſe hereby we enter into the knowledge of other mens conceits, and whatſoeuer is concluded within, is as it were, vnlocked and layde open by this ſenſe of hearing. But ſome will haply ſay that we may attaine vnto knowledge by reading without any helpe of hearing. We anſwer thus, that no man knowes how to reade which hath not firſt learned it by the meanes of Hearing. I will omit that which is found by experience, that a liuing and audible voyce doth better inſtruct then the ſilent reading of bookes, and that thing heard take a deeper impreſſion in the minde then thoſe which bee only read, and hence haply was *Plinie* brought to beleeue the Memory had his place in the loweſt part of the Eare. Others there are who doe call Hearing the Senſe of Memory, whence in their Hyeroglyphickes they were woont to decipher and paynt Memory a hand holding an Eare; I alſo paſſe this by, that Hearing is after a ſort the ſpy of the life and Manners, whereupon *Iſocrates* deſirous to try the towardneſſe of a young man whom hee ſaw: *Speake*, ſaith he, *that I may ſee*; And in holy Writ, *Iob* commaunds that *they bend their Eares and ſee*, accounting for certaine that the Hearing is the very meanes of diſcerning & iudging of mens minds. Hearing is the gate of the mind. Hearing is the ſenſe of memory.

But the deſire I haue of breuity commands me to abridge my diſcourſe. There remaines now of the externall ſenſes onely Sight, which if it be not ſuperiour and aboue the precedent ſenſes, in dignity and honour, yet it is not a whit inferior to any of them. I ſay in dignity not in neceſſity: for if thereby we eſteeme their prerogatiue, Sight muſt come behind, but if you reſpect the ſituation the conformation and the vſe of this Organ, you may pronounce it more worthy by many degrees then any of the other. The prayſe of Sight.

For their ſituation and place, it is in the moſt erected region and diuineſt part; beſide prouident Nature, hath on euery ſide bounded them with a concauous valley. They haue a ſpherical or round figure, which is no ſmal argument of their excellency. Seeing Nature is neuer wont to vſe this noble figure, but when ſhe endeuoures to effect ſome difficult or excellent worke. And for their vſe we may thence eaſily inferre their preheminence, for beſide that they watche for the ſafety of the creature, detecting things hurtfull, manifeſting things profitable and laying open the differences of all things which are contained in this large Vniuerſe, they bring vs vnto the knowledge of all things, ſo that they alone are fit and ſufficient for inuention and diſcouery of arts, and which is the moſt all they do make manifeſt the great Creator of all things by thoſe things which are viſible, in the knowledge of whom doth our chiefe happineſſe conſiſt. They therefore which be deſtitute of theſe moſt diuine Organs may truly profeſſe themſelues miſerable, ſeeing they remaining in perpetuall darkeneſſe cannot admire and contemplate the workes of Almighty God, nor behold the infinite variety of the kinds of things, neither yet dare euer affirme that they know any thing certainely, becauſe of force they muſt beleeue that which the Heare related to them from others. From their place. Figure. And vſe. The miſerable condition of the blind

That ſpirituall and moſt noble obiect of the Eye (I meane the light which is they Queene of all qualities) who doth not admire? and hence alſo coucludes the ſupremacy of this Senſe; for the Eyes by the fruition of light doe diſtinguiſh life from death. Doth not *Hippocrates* the piller of Phyſicke, propound vnto vs moſt certaine ſignes of the paſſions of the mind by the Eyes? By theſe as by windowes we may pry into, and penetrate the deepeſt and moſt ſecret conuayances in the ſoule; and therefore *Alexander* not vnaduiſedly ſayd, that the Eyes were the *looking-glaſſe of the ſoule* whereupon ſome famous Phyloſophers haue placed the chiefe ſeate of the ſoule in the Eyes. For theſe Eyes doe burne and ſhine, they twinckle, they winke, they are ſorrowfull, they laugh, they admire, they loue, they luſt, they flatter, and in one word they decipher and paint the image of the Mind with The obiect of the Eye moſt noble.

The Braine was made for the eye.

ſo artificiall a pencill, that they ſeeme to be a ſecond ſoule; what ſhould we ſay more? doth not *Galen* himſelfe ſo highly extoll this Organ that hee thought the Braine was onely framed for their ſake, a part ſo neceſſary and excellent that it makes vs verie much reſemble the verie diuine Nature? And doth he not moreouer write, that the whole Head had the higheſt place in the body, onely becauſe of the Eyes?

That it is a little world

A commendation doubtleſſe wonderful, yet not more admyrable then competent & worthily deſerued. For being a man of great and profound knowledge, he conſidered that the Eye was the true *Microcoſme* or *Little world* in reſpect of their exact roundneſſe and reuolutions: wherein beſides the Membranes which I dare boldly call the ſeauen Spheres of Heauen, there be alſo the foure Elements found.

The foure Elements in the eie.

That Fire is there we will prooue in a conuenient time and place. That there is Aire who will denie which vnderſtands with what plenty of ſpirits they do abound? As for Water, who doth not ſee it in the Eye doth prooue himſelfe more blind then a beetle, all the other parts we will liken to the Earth.

The Apple & Rainbowe of the eie.

If you looke vpon the *Pupilla* or Apple, ſhall not you ſee ſhining Starres, yea rather a beaming Sun? Wherefore thou maiſt not vnfitly call the eies with the Poet, τὰ ἠλίου πυλάς *The Gates of the Sunne*. Shall you not perceiue heere the diuerſ-coloured Rainbow framed with a ſeuen-fold circle? Shall ye not alſo obſerue Haile and infinite other things, which do moſt fully declare the excellencie of this Senſe by themſelues without any additament of our Oration?

Agellius.

But ſeeing as *Agellius* ſaith, it is more blame-worthy to praiſe a thing ſlightly & coldlie, then earneſtly to diſpraiſe it, leſt we ſhould ſeeme to preiudice the worth of ſo excellent workes of Nature, we will heere make ſtay and addreſſe the ſmall portion of our capacities vnto a more abſtruſe contemplation concerning the Nature, Manner, Number, Order, *Medium*, Obiect and Organs of all the Senſes in Generall: afterward we wil deſcend vnto particulars.

QVEST. I. *What Senſe is.*

The definitiō of Senſe by *Ariſtotle.*

HAuing by way of Præface ſet foorth the Excellencie of the Senſes, we are to proceede vnto a more full diſcourſe of thē, which that we may the better accompliſh, before we aſſay their particular handling, we will take a Taſte of them in general, which may make way to the particulars, and may ſerue inſtead of a preamble, for the better vnderſtanding of the Reader. Firſt of all therefore, it is to be conſidered what *Senſe* is. *Ariſtotle* in the 2. *de Anima* Texte. 12. ſaieth, *That Senſe is that which can receiue ſenſible Formes without any matter*. But he ſeemeth to define ſenſe in *potentia* only or *power*, which haply he would inſinuate by the word *poteſt* or *Can*, eſpecially becauſe this cannot bee a true definition of *Senſe* as it doth indeed and really *perceiue*; for a glaſſe alſo dooth receiue ſenſible formes without any materiall ſubſtance, & yet that perception is no ſenſe. Whence *Iohan. Grami.* vpon the 127 Text of the ſecond Booke *De Anima* ſaith, *To bee able to perceiue is not onely to receiue ſpecies or formes without the matter, but there is alſo requiſite an Animall faculty which is not in all things that receiue the formes of ſenſible things without the matter*; as if he had ſaide, euen as it is in glaſſes.

Iohn. Grammaticus.

Alex. Aphrodiſ.

But the Philoſopher would ſhew what manner of perception was neceſſary to Senſe that it haue the acte of perception, and how the obiect ought to be diſpoſed, except by the word *Perceiue* hee vnderſtood *Diſcerning*, which Philoſophers doe ſometimes promiſcuouſly vſe, as we may gather out of *Alexander Aphrodiſæus*, who vpon the 3. Booke of the Metaphyſicks ſaith, *That Senſe is an apprehenſion or diſcerning of preſent ſenſible things which are without the Senſorium or Organ*, and this is Senſe in deede and acte, for wee are then ſaide to *perceiue* when we diſcerne the Obiects, which *Simplicius* vppon the 155. Text of the third Booke *De Anima* hath wel noted, defining Senſe to be A knowledge or diſcerning ſtirred vppe in the Organ, firſt receyuing his acte from the ſenſible obiect: ſo that *Ariſtotle* by receyuing vnderſtood nothing but the knowledge or diſcerning of the obiect. And the ſame definition he doth accurately and diſtinctly declare in the ſecond Chapter and 138 Text of the third Booke *De Anima* where hee ſaith, *That the Inſtrument of euerie Senſe doth receiue the ſenſible obiect without any matter, and therfore the Obiects be-*

Simplicius definition.

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ing remooued, there are in the Instruments of the Senses, Sensations and Imaginations. VVhat can be more euident? For how can the Sense of that obiect remaine in the Organ when the obiect is set aside, if it should onely receiue it without any acte of discerning? Are we not taught the contrarie in glasses? which because they onely receiue but knowe or discerne nothing, therefore presently as the obiect is remooued, they loose the Image. We will therefore out of this which hath bene saide gather a most cleare and absolute definition of Sense on this manner, That *Sense is a knowledge or discerning of the obiect receyued formally in the Organ.*

A Sense is made with the knowledge of the Obiect.

QVEST. II. *What Action is, and how Action and vse do differ.*

Averrhoes verie worthily saieth in the first Booke *De Anima* and the 51. Text, that the first and chiefe consideration of Sense is, *Whether it bee to be accounted amongest the Actiue or Passiue vertues or Faculties of the soule*, that is, *whether it be accomplished by action or passion*, for he which is ignorant of this can neuer attaine to the perfect knowledge of the manner of Sensation. Considering therefore of this matter by the counsell of *Auerrhoes*, I haue heere determined for the more euident clearing of this question to declare what Action is, and also what Passion is.

what action is

Action therefore (which the Greekes call ἐνέργεια) *is a certaine actiue motion, proceeding from any thing fit for action for the obtaining of some thing.* It is called an *Actiue motion* by *Galen* in the first chapter of his 17 Booke *De vsu partium* and in manie other places, and that not without good reason, seeing that there is as well an Actiue motion as a Passiue motion. Manie call that an Actiue motion which is performed by the proper Nature of the thing, and of it selfe alone: and that Passiue which is caused by some externall agent. As for example: the walking of a creature is an Actiue motion in regard that it proceedeth from the proper & internall Facultie of the creature. But the casting of a Stone vpward is a Passiue motion, because it is performed by another & not by the proper internal principle. But because al motion made either by an internal or external agent, in relation to the patient is Passiue, and in relation to the Agent cause is Actiue, therfore certainly the casting of a Stone ought no lesse to be iudged an actiue motion then the walking of a creature, neither dooth this deserue lesse the name of a Passiue motion then that; for a creature in walking doth suffer, else wee must determine (which is more absurd) that there may be an action without passion.

Why action is called an Actiue Motion.

What actiue internall motion is.

But in my opinion the Logitians distinguishing actiue motion from passiue onelie in some respects and not indeed; haue more truly said, that Actiue motion is that which proceedeth from the agent for the effecting of some thing; and Passiue that which is receiued of the patient to make alteration in it: wherfore both action and passion being indeed one motion, as it commeth from the agent is an Action, and it is receiued of both Patient is a Passion.

Action is relatiue.

How Action and Passion do differ.

It is added in the aboue-named definition, *from any thing fit to performe action*, because euery thing doth not produce an action but that which hath a disposition and fitnesse for the performance of that action. This fitnesse or habitude vnto Action, called in Greeke εὐχρηστία or an agility of vsing, *Galen* in the first chapter of his 17. Booke *De vsu part*: calleth *Vse*, which signification doeth much differ from the word *Vse* taken for the acte of vsing or for the handling and exercising of an action, whereof *Cicero* speaketh in his *Topickes*. For *Galen* vnderstandeth by *Vse* an aptitude and disposition of the partes to performe an action, which parts if they were composed by Nature without this fitnes they could neuer performe any action, and so they should haue bene made in vaine.

Diuers acceptions of vse.

This fitnesse in liuing Creatures consisteth in the temperature of the similar parts and the Legittimate conformation of the dissimilar which dooth comprehend the Figure, Magnitude, Site and Number of them. Therefore this due Temperament and conformation, as it is fit for operation is vnderstood by the word Vse.

Wherein this vse consisteth.

Moreouer, this Vse is two-fold, Principall and Assistant. I call that Principall, by the helpe whereof the Agent doth principally performe and exercise his operation. The Assistant I call that which is as a Handmayde, to helpe and further that the function be the better performed. Againe, this Principall is also two-folde. Not subordinate and subordinate. The Assisting vse is three-folde, first that which doth truly helpe, and that which

Vse is twofold

doth conſerue or keepe; and thirdly, that which addeth ſome ornament or beauty to the Action.

The vſe not ſubordinate. The vſe ſubordinate.

That which is *not ſubordinate*, doth accompliſh a principall Action which is not inferiour to any other: But that is ſubordinate, for whoſe ſake the Agent vndertakes an action which is ſubordinate and preparatorie only. That Vſe or aptitude which doth only helpe and conſerue, may be ſeen in the lids and haires of the eye. And *Gal.* in the 13. Chap. of the 11. booke *de vſu partium*, doth plainely affirme, that the ornament and beauty of the action is to be referred vnto this helping or aſsiſting Aptitude.

Obiection.

But here ariſeth a difficulty, which is not ſlightly to be ouer-paſſed; for if thoſe things be true which we haue ſaide as we profeſſe them to be, it will neceſſarily follow that in liuing creatures euery organ ſhall haue ſome *vſe*, in as much as there is no part in the whole liuing body which is not fit and diſpoſed to operation after ſome of the fore-ſaide wayes, as it is taught in the firſt Chap. of the 17. booke *de vſu partium*. But *Galen* ſeemeth to differ from himſelfe and to contradict this doctrine in the 8. Chap. of his booke *de morb. diff.* Where he ſayeth, that ſome parts haue vſe onely and not action. Some haue both vſe and action, and others haue action onely and not vſe.

Solution.

But this knot may thus be vnlooſed and this contradiction reconciled, if we ſay; that to haue action and vſe is affirmed as well of that which doth helpe, as of that which doth principally apply it ſelfe vnto the performance of the action: So euery part of the body ſhall haue both action and vſe; but ſo, as to *haue action* doth ſignifie that aptitude by which the action is eſpecially performed, and to *haue vſe* that for whoſe ſake or by whoſe means the vſe and action is holpen and aſſiſted. The *action* therfore is principally from the parts, and the *vſe* they haue ouerplus, that is, that aptitude & diſpoſition whereby the principall action is either perfected or conſerued, or receiueth ſome additament of beautie and ornament.

QVEST. III. *Of the end of Action.*

What is the end of Action. The Action is leſſe worthy then his end.

THE laſt part of the definition was, *for the obtayning of any thing*, that the profit & end of the action might be intimated, which is the fruition of that where-vnto the action is directed. This is after the action in generation and conſtitution; but it is the firſt in dignity and excellencie, as *Galen* declareth in the 13. Chap. of the 11. booke *de vſu partium*. And as the fruition of any thing is the profit of the action, ſo the action is the profit of the vſe: ſo that (as *Galen* ſaith in the 1. chap. of his 17. *de vſu partium*) Thoſe things which haue an vſe for action, haue a double profit propounded to themſelues: that is, the action it ſelfe which is the profit of the vſe, and the fruition which is the profit of the action.

Queſtion.

Here doth ariſe a moſt intricate difficulty to be reſolued, for becauſe (ſaith *Galen* in the 8. and 16. Chapters of his firſt booke *de vſu partium*) There is required vnto the knowledge of the profit of the particulars, a procognition or fore-knowledge of the action, I thinke we muſt diſtinguiſh betwixt the action of the parts and the profit of them, and ſo it is falſe, that the action is the profit of the parts or of their aptitude.

Solution. To know the Action is two wayes vnderſtoode.

The action of the organs may be knowne two wayes, either vniuerſally and abſtracted from their organ, ſo that the production of the action may be made manifeſt without any conſideration of the organ: Or it may be knowne as it hath relation to the organ, that ſo it may be manifeſt by what meanes it proceeded from the organ, and what euery part did performe which is found in that organ. Now *Galen* affirming that the Profit of particular things cannot be vnderſtoode vnleſſe we accurately fore-know the action, doth vnderſtand by the name of profit the *Action*, and ſo would ſignifie, that the particular action ought to be vniuerſally & abſtractedly fore-knowne, that it may appeare by what meanes it comes from his organ, and that the function of euery particle which is found in that organ (though neuer ſo ſmall) may be known. And ſo it is not abſurd, that the action ſhould miniſter knowledge to it ſelfe, and ſhould be both more knowne and more obſcure then it ſelfe.

The difference betwixt vſe & profit.

The vſe therefore of the parts and their profit, doe differ as the words of *cauſe* and *effect*, though Vſe doe alſo ſignifie Profit, whereby it is manifeſt that the one is more large in his ſignification then the other.

Moreouer, that thing vnto the fruition of which the action doth ayme, is either ſeperated from the action ſo that the action ceaſing it is abandoned; or elſe it doeth only conſiſt

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and hath his *being* in *Fieri*, that is, whilst it is in motion, & this is called in Latine *opus*, in Greeke τὸ ἔργον *actionis*, the *worke of the action*. *Galen* therefore in the 1. *de nat. fac.* saith well, that the worke is distinguished from the action and is an effect thereof as blood, flesh, a nerue or such like are the effects of the action of the Liuer and of the Seed. The difference of the worke and action.

Sometimes by the name of *worke* we vnderstand the Action, for concoction, sanguification and distribution, are certaine *actions* and yet the *workes* of Nature also; but wee must beware least we call all the workes of Nature Actions; for flesh, a nerue and bones are the workes of Nature, and yet no actions of Nature.

QVEST. IIII. *How manifold Action is.*

Galen in the first Chapter of his Booke *de vtilitate respirat.* deuideth the action of a liuing body into an vniuersall and a particular. I call that an vniuersall action which is perfected by the whole body as by his proper instrument, as are the life, which life *Aristotle* in the 10. of his Ethicks chapter third, and *Galen* in the place aboue quoted saye; is a kinde of action of the creature, as also are those foure which doe attend it: Retention, Concoction, Attraction and Expulsion. What is an vniuersall Action.

And a particular action I call that, which belongeth to some one part or organ, for the profite and behoofe of the whole body. But they are almost infinite, yet all allotted to their own proper parts, and so mutually conioyned and with such concord that they do all serue and helpe the operations of the whole, and do all conspire and as it were with one consent suffer together. What a particular Action is.

For great organs as the Head, the Breast, the *Abdomen* or Paunch & the ioynts do with all their functions immediatly serue the whole body. And the lesser which are parts of these are also referred to the action of the whole. As the Eye whose action being wholly destinated to the safety of the creature is Sight, which Nature by the chrystaline humor doth exercise; all the other parts doe concur vnto the constitution thereof, and serue either as causes without which vision cannot be made as the opticke nerues doe; or as a cause of the better performance of this Sense as the muscles and coates; or lastly as conseruing and defending causes, as the Eye-lids and the Eye-browes. The consent of the parts.

Some doe subdiuide a particular action into a common or publique and into a proper or priuate action; & they call that common which is referred vnto the vse of the whole and not of any priuate part onely, as are those operations called Animal, to wit, going, apprehension, Vision, Hearing, Smelling, Tasting, Touching, Imagination, Ratiocination & Memory. Amongst the Natural operations, Chylification or the action of the stomack changing the meate into Chylus, Sangnification, Expulsion of the excrements, the sucking of the Vrine out of the veines, attraction of seede, the conformation of the Infant, with many other. What a common Action is

They call that a proper action, which is addicted vnto one onely part, such as they affirme to be Retention, Concoction, Attraction & Expulsion, which I haue comprehended in the number of vniuersall actions, but they say they belong vnto the proper vse of the part. What a proper Action is.

But this manner of distinguishing is not to be in euery respect admitted in my opinion, because it doth much rather ingender a confusion then further our vnderstanding, in that they confound a proper and particular action with an vniuersall. For why should that action which pertaines to the whole and is vniuersall and common to all the parts, be called proper and priuate? How shall it bee allotted to one onely part? If that which they call common be assigned to one organ, how is it said to be common? Yet if any man shall say, that it is called common by accident because it tendes to a publique and common good, him I will not gaine-say. But it will be obiected, that that which is called by them a proper and priuate action, will by the Physitians neuer be admitted to be vniuersall and an action of the whole body, and of all the parts thereof. Obiection.

For although attraction, retention, concoction, expulsion, do agree to the whole and to all the parts, yet they be so appropriated to their seuerall parts, that they seeme to be proper vnto euery particular, because that the seuerall parts doe conueniently exercise them by their owne nature. But I thinke, that attraction being restrayned to some certaine humour, doth not enduce the propriety of attraction, but of that which is attracted by it. Solution.

Now that which is drawne, and the attraction it selfe doe differ. So a bone doth attract, yet not as it is a bone, but as it doth participate of life and the function of the whole, yet it doth attract a proper iuyce as it is such a part and no other. But be it so, that attraction and other Naturall functions doe belong and be ascribed to a bone, a gristle, a membrane,

Membrane & other ſuch like parts as proper vnto them, in regard that they all do properly and in their owne nature conueniently exerciſe them: yet ſhall it follow that euery part of the bone and portion of a griſtle or ligament ſhall performe a proper action. One and the ſame iuyce is common to all the particles of the ſame ſimilar part. Wherefore this ſubdiuiſion of a particular action in my opinion is not allowable.

Some parts haue a double action ſome onely one.

But I conclude from that which hath bene ſayd, that ſome parts do performe a double office, namely one common to all other parts, another proper which is committed to them and to no other parts; and yet tending to the vſe of the whole. And this office or function is three fold, to wit, Animall, Vitall and Naturall. But what euery one of theſe is and how manifold we haue before declared, and therefore they are here onely preſuppoſed.

What action is manifeſt of it ſelfe and obſcure of it ſelfe.

Moreouer ſome actions be manifeſt by themſelues yet their Organ is obſcure and hidden, others be cleare and manifeſt both of themſelues and in reſpect of their Organ, others be obſcure both in themſelues and in their Organ. I call that action manifeſt of it ſelfe which is ſenſible and may be iudged of by the Senſe; and that obſcure of it ſelf which doth not appeare but from thoſe *workes* which proceed from it. I call alſo that manifeſt by the means of his Orgã, whoſe organ doth preſently appeare, & in this without all doubt do al conſent: but I account that obſcure in regard of his organ, when the action doth appeare, yet the Organ doth not preſently be wray it ſelf without much ſtudy, & diſcorſe of the mind which is held of ſome only for probable where about many do diſſent. Thoſe which be manifeſt both in thẽſelues & by their Organs be theſe; vociferation, pulſation, reſpiration, the locall motion of the parts, expulſion of excrements, the expulſion of vrine, the emiſſion of the ſeed, &c. In reſpect of both, with *Galen* in the 8. & 16. chap. of his 1. book *de vſu partiũ* are the apprehenſion of the hand, the walking of thee feete, chewing, viſion, hearing, &c.

Finally, theſe are eſteemed obſcure in reſpect of both; the tranſmiſſion of the blood, the carrying and recarryinge of the ſpirits, the generations of animall ſpirits, he preduction of vitall, the ſucking of vrine out of blood, chylification, ſanguification, and the generation of ſeede.

QVEST. V. *That Senſe is not a pure paſſion.*

Whether the obiect or the organ doe worke in the ſenſe.

Eeing therefore that vnto an action there doe neceſſarily concurre an agent and a patient; the *agent* for to worke, and the *patient* to be a fit ſubiect for the *agent* and to receiue the action; it may now be demanded whether the action proceede from the Organ vnto the ſenſible obiect, or from the obiect vnto the Organ, and whether this be to bee accounted an *agent* the other a *patient*, or on the contrary. Concerning this poynt there bee diuers opinions of Authours, for ſome maintaine Senſe to be paſſiue, others actiue, others both actiue & paſſiue. *Ariſtotle* doth contend for thoſe which would haue Senſe to bee paſſiue, eſpecially in the 118. text of his 2. book *de Anima*, wherein expreſſe termes he affirmeth that to *perceiue* is a kind of ſuffering, & alſo calleth the obiect an *agent*: again in the 51. text of the ſame booke, he ſaith, that Senſation hapneth in that which is moued and ſuffereth. And he ſeemes moſt exactly to demonſtrate it in the 12. text of his 7. booke of Phyſicks, ſaying, *That the ſenſes are altered: for they ſuffer, and their action is a motion through a body which ſuffers in the Senſation* So that it may be gathered out of theſe places of *Ariſtotle* that Senſe is made paſſiuely, that is, that the act of Senſation is not made by the Senſe, but by the ſenſible obiect, and that the ſenſe doth nothing elſe but receiue the ſpecies from the thing obiected and ſuffer from it: but this opinion though it be approued of many and be held for *Ariſtotles*, yet it is neither agreeable to *Ariſtotle* nor to the truth. That the places cited out of *Ariſtotle* doe not confirme this we will proue by and by, when as by many reaſons we ſhall haue demonſtrated how farre diſtant it is from the truth. For firſt, if the Senſe ſhould onely concurre paſſiuely vnto ſenſation, that is, if ſenſation were onely a reception of the ſenſible ſpecies,

Their reaſon which ſay ſenſe doth ſuffer.

That opinion diſproued. 1. Reaſon.

then we muſt needes euen when we are aſleepe heare, ſmell, & ſee, ſeeing therfore; that although when we are a ſleepe ſome certaine noyſes or ſounds be carryed to our eares, and ſome odors do ſtrike the noſthrils and colours (if ſo be we ſleep with our eyes open as ſome doe) bee preſented to our eyes, yet we doe not heare or ſmell, or ſee; it will follow neceſſarily that ſomething elſe muſt concurre vnto ſenſation beſide a ſimple reception of the ſenſible ſpecies.

2. Reaſon.

Add further, that though wee receiue a viſible thing into our Eyes, and a ſound into our Eares, yet we neither ſee nor heare when wee are intent another way, or haue our vnderſtanding exerciſed in greater matters. Wherefore there muſt be ſome part of the mind preſent in ſenſation; and hence it is that wee ſometimes ſeeke a very ſmall thing and yet ſee it not though we be very neare it, and though it be already re-

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ceiued into the eye: Surely this is an argument moſt euident that the mind muſt be applied to that thing which we would ſee, and that ſomething more is required to Senſe then the bare reception of the ſpecies, for elſe a glaſſe might alſo *perceiue* in as much as it doth receiue the images. Moreouer, if onely the reception of ſpecies were a ſenſation, all action ſhould proceede from the ſenſible ſpecies, & that ſpecies ſhould be ſo prompt vnto action that it would worke euery where and vpon euery ſubiect, and ſo would make ſenſe; euen as heate doth make hot euery where and euery thing; but this is impoſſible, for who euer affirmed that ſenſe was made out of his proper Organ.

Senſation is not therefore an action onely of the ſenſible ſpecies, neither was it *Ariſtotles* opinion; for in the 37. text of his ſecond booke *de Anima*, hee teacheth the plaine contrary, and affirmeth manifeſtly, that the ſoule is the efficient cauſe of ſenſation, and therefore not the ſenſible thing, and in the ninth chapter of the ninth booke of his *Metaph.* he prooues that viſion is an action of the ſight. And what can be more manifeſt then that which he expreſſeth in the ſecond chapter of his book *de ſenſu & ſenſili* where he reprooueth *Democritus* for ſaying that viſion was an operation of the obiect: and propounding the conformity of the ſimilitude which the ſenſible thing hath with the Organ, hee ſaith, *the ſenſible thing cauſeth the ſenſe to worke*, as if he ſhould ſay, *the obiect doth excite and prouoke the ſenſe vnto action*. The poynt is as cleare as the light, but yet what ſhall wee anſwer to thoſe contrary places, quoted euen now out of *Ariſtotle*, for it ſeemeth by them to bee plainly affirmed that ſenſe is paſſiue. But I deferre the reconciliation of this contradiction till the ſeuenth Queſtion, where you ſhall haue alſo *Placentinus* his reſolution.

Ariſt. thought the contrary.

QVEST. VI. *That Senſe is not a ſimple action.*

THat Senſation is not a meere paſſion, is plaine from that which hath beene ſaid. Now it is to bee conſidered, whether it ought to bee called an Action, that is, whether Senſe doe *perceiue* onely by doing or acting. And that ſetting aſide all digreſſions, I may come to the matter; I ſay. Seeing euery Agent in doing and acting doth alſo ſuffer againe, it followes neceſſarily, that the Senſe doth continualle ſuffer ſomething from the ſenſible Obiect: for there is no man ignorant that to the effecting of Senſation it is neceſſary that the Senſe be conuerted into the nature of the ſenſible thing, but it cannot be conuerted but by alteration, becauſe things of an vnlike nature cannot be made of one nature, except the one of them be changed, but the Senſe and Obiect be of an vnlike condition. And this is it where-vpon *Ariſtotle* ſo oft beateth, that the Senſe is potentially that which the ſenſible thing is actually and really, and except the Senſe doe paſſe into the nature of the organ Senſation cannot be performed. Whence it followeth, that the ſenſible thing doth alter the Senſe and turnes it into it owne nature, and therefore *Ariſtotle* often times calls Senſe an alteration, for ſo Senſe is made. Now if the Senſe be altered and changed by the Obiect, it is neeeſſary that it muſt ſuffer, becauſe the ſenſible thing when it altereth the Senſe worketh vpon it. Hence it is more then manifeſt that Senſe is not perfected by a ſimple Action.

Paſſion is neceſſary to Senſe.

The ſenſe & the obiect be vnlike.

The obiect muſt alter the ſenſe.

QVEST. VII. *Placentinus his opinion.*

IF therefore Senſe be perfected, neither by action nor paſſion, how ſhall wee ſay that it is performed? I anſwere, that it is abſolued and perfected, neither by action onely nor by paſſion onely but by both together, that is both by action and paſſion. That action is requiſite vnto Senſe, is prooued by the Negatiue part before refuted. We will adde ſome arguments wherewith we are purpoſed for the preſent to confirme the affirmatiue. And firſt, if Senſe ſhould be made without acting, it would follow, that the vegetatiue faculty ſhould be more noble then the ſenſatiue, becauſe that to *doe* is more noble then to *ſuffer*, but no mã doubts that the faculties of the vegetatiue ſoule are Actiue, wherefore leaſt we ſhould fall into an abſurdity vnheard of and monſtrous, wee muſt graunt that the faculties of the ſenſatiue ſoule are alſo Actiue. Furthermore, if the Senſes ſhould not *worke*, they were in vaine giuen vs by nature, becauſe the organ onely would haue ſufficed vs for paſsion. Againe, if the Senſe were onely paſsiue, neither could the ſight ſee, nor the hearing heare, nor the ſmell performe his owne function, neither were any ſuch like predications true of the other Senſes, becauſe theſe predications doe intimate that the Senſe doth produce out of it

Senſe is abſolued by action and paſſion together

That action is requiſite. Reaſon.

What life is.

it ſelfe an act of Senſation. Fourthly, Senſation is an operation of life, and therefore proceedeth from an internall and actiue originall of motion, for life is *an internall motion, performed by that which liueth.* Vnleſſe therefore you graunt that Senſation is an Action, it cannot be an operation of life.

Senſe is an operation of the ſenſatiue Soule.

Laſtly, Senſation is a ſecond act, and the ſenſatiue ſoule is a firſt act: for to *perceiue* is an operation of the ſenſatiue ſoule, and therefore *Ariſtotle* beſide many other places, affirmeth in the 7. Chapter, and the 127. Text of the 2. booke *de anima*, that to *perceiue* is ſomething more then the ſuffering of the Senſe, whereby it is manifeſt that Senſe is an Action.

Queſtion.

How it is a Paſsion hath beene before declared. But it may here be doubted by what meanes two Agents can concur vnto one Act of Senſation, and this doubt is worthy the noting: for if the ſenſible Species doe make Senſation, and the ſenſatiue faculty doe together there-with perfect the ſame Action, there muſt needes bee two immediate effectiue or operatiue Principles of one and the ſame Action; which is impoſsible: becauſe that Senſe (witneſſe *Ariſtotle* in the 9. Chap. of the 9. booke of his *Metaph*) is an *iſſuing* Action, now an iſſuing & ſimple Action cannot proceede from two immediate Agents really diſtinct.

Senſe is an immanent Action.

Againe, it is impoſsible that an iſſuing Action ſhould proceede from an outward originall, but from that where-out it ought to ariſe and to bee perfected.

Solution.

For the enodation and reſolution of theſe difficulties, and the explication of a double truth, we muſt know that Senſe is many wayes to be vnderſtood.

Firſt, as it is a reception of the Species, and ſo it is a Paſsion, for in that reſpect it ſuffers of the Obiect. And of this did *Ariſtotle* vnderſtand that where he ſaith, that *to perceiue is a kinde of paſsion or ſuffering.*

Secondly, as it is a diſcerning and knowing of the Obiect by the Species, receiued into the Senſe, and ſo it is an Action, for ſo the faculty doth worke vpon the Species, and ſo the ſight doth ſee, and the hearing heare, and ſo of the reſt; and ſo is *Ariſtotle* to be vnderſtood, when he ſaith that the Senſes be Actiue.

Thirdly and laſtly, Senſe is taken for both together; to wit, for an Action and Paſsion, when as the whole Senſation that is the perfect act of Senſe is vnderſtoode: for firſt, vnto the perfection of Senſation, there is neede of Paſsion or an alteration of the Organ, from whence afterward followes the Action of the faculty, which *Ariſtotle* did excellently note, where he ſaith, that Senſation begins at the Inſtrument and body, and is determined in the Soule: as if he ſhould ſay the alteration of the Organ and the diſcerning of the ſenſatiue faculty doe accompliſh a perfect Senſation. The ſame alſo muſt wee vnderſtand when he ſaith, that to *perceiue* is a ſecond Act, & the ſenſitiue Soule a firſt Act, becauſe to *perceiue* is the operation of the ſenſatiue Soule. Thus therefore may the difficulties propounded be eaſily reſolued, and ſo *Ariſtotle* redeemed from contradiction.

Senſe begins in the Body, and ends in the Soule.

QVEST. VIII. *How the faculty is wrought in the Senſe.*

Queſtion. Senſe is no alteration, but a knowledge of the alteration.

SEeing that (as *Galen* in the 6. Chapter of his ſecond booke *de Placitis* witneſſeth) Senſe is not an alteration, but a *diſcerning* or knowing of the alteration; becauſe the ſenſatiue faculty is not affected with the Obiect, but onely the Organ: it may therefore heere worthily be doubted, how the faculty can attayne to the knowledge of the Obiect, ſeeing it ſuffereth nothing from it, neither doth the Obiect *Act* before the faculty *perceiue*. For the Action of the ſenſatiue faculty is a knowing and diiudication of the ſenſible thing: but it ſeemeth not to be poſsible, that the ſenſatiue faculty can come to the knowledge of the Obiect, except that either the faculty be ſome way affected by the Obiect, or the Obiect by the faculty, but neither of theſe can be. For firſt, the Obiect cannot work vpon the faculty, becauſe an incorporeall thing, is not affected by that which is corporeall. But the faculty is incorporeall, and the Obiect corporeall. Beſide, the Soule is not capable of Paſsion, and therefore neither are her faculties capable. Neither can the ſenſatiue faculty alter or change the Obiect. And this is playne, as by many other reaſons, ſo alſo becauſe her ſole and onely Action is Senſation. I ſay therefore, how comes it to the knowledge of his Obiect? And what is the efficient cauſe of the diiudication or iudgement, which the faculty giues of the ſenſible Obiect, which we perceiue to ariſe from the motion of the Organ.

The Obiect cannot worke vpon the faculty.

The faculty cānot change the Obiect.

Solution.

The Organ is chang'd by it ſelfe, the faculty as it is in the Organ.

I anſwere: that the ſenſatiue faculty doth ſuffer, and is changed by the Obiect, not by it ſelfe but by accident, to wit, as the organ whoſe formall part & eſſence the faculty is, is changed by it. For ſeeing the faculty is as it were the εἶδος or *forme* from whence the

Action

Action of the organ doth proceede, when this corporeall Inſtrument is changed by the ſenſible obiect, it remaineth that the Faculty it ſelfe (which together with his ſenſible inſtrument doth grow vp into one bodie, and do both conſpire vnto the ſame action) is altred by accident and doth perceiue the alteration of his Organ. For all Organs of ſenſation do ſuffer by reaſon of their bodye, but in reſpect of their Senſatiue Faculty they performe an Acte.

Paſsion doth affect the Facultie as it depends vpon the organ; Action is the diiudication or iudgement, which is the office of the ſenſitiue Facultie, or of the whole organ in reſpect of that Faculty wherewith it is endowed: not that the Faculty it ſelfe is altered or doth ſuffer, but becauſe it *Perceyueth* the alteration of the organ.

QVEST. IX. *Whether the knowledge of the ſenſible thing be perfected in the Organ.*

ALthough it be made manifeſt by that which hath beene ſaide, that the proper action of the Senſatiue Faculty is the diiudication of the ſenſible thing, yet there ſeemeth to be ſome difficulty behinde. for, if the Facultie doe make this iudgement of the obiect in the *ſenſorium* or Organ, then thoſe which ſleepe with open eies ſhould alſo ſee becauſe the colour doth alter the Organ. In like manner a ſound might be heard, odours ſmelt, and any tactile quality might be felt by vs; ſeeing that the Organ is altred by the Obiect, and yet when wee are aſleepe we neither do ſee, nor heare, nor *Perceyue* with anie other Senſe except the Obiects be verie vehement. Haue therefore the Poets truly faigned that ſleepe is the brother of death, becauſe it dooth depriue vs of all our ſenſe yea of our verie Touch; inſomuch that it ſeemeth to extinguiſh the creature & bereaue it not of Senſe onely but of life alſo? Or elſe do we *perceyue* while we ſleepe, and know not that we haue Senſe? The firſt cannot be, for although ſleepe haue a great correſpondencie and affinitie with death, yet it doth not depriue the creature of ſenſe. For theſe things do concurre vnto Senſe: a conuenient obiect, an organ fitly diſpoſed, the alteration of the ſame organ and a ſenſitiue Facultie, al which things we haue euen when we ſleepe.

The poets ſay ſleepe is the brother of death. Diſproued.

What things do concur to Senſe.

Firſt, the Obiect is preſent, for colour though we be aſleepe, yet is it the Obiect of ſight, and continueth to be actuallie an obiect as long as it is illuminated with the light of a Candle or with the daylight; ſo alſo it is with ſounds, odours and other obiects of the Senſes. The Organ is alſo preſent and ſo is the alteration of the ſame; ſeeing there is nothing which can hinder the operation of the ſenſible ſpecies vpon the organ, or the alteration of the ſame. Neither is the Faculty wanting: for if the Facultie of one ſenſe ſhould faile all the Senſes would be forfeited, and ſo of a liuing creature ſhould be made a Plant depriued of ſenſe and motion.

Moreouer, though we ſleepe, yet our organs liue and they liue by the Soule. If therefore the ſoule with all her powers and faculties be wholy in the whole, and wholie in euerie part, it muſt needs be that if the creature liue the Faculties of Senſe muſt bee preſent in euerie place where the Soule is. But the ſoule is found in the organs of ſenſes, yea euen when we are aſleepe; except you will ſay that the Soule dies when wee fall aſleepe. Wherefore it neceſſarily followes that the Faculty of Senſe is there alſo preſent in the organ.

The ſoul with her Faculty is wholie in the whole.

Seeing therefore in ſleepe we haue the obiect actuallie prepared vnto ſenſation, ſeeing alſo the organ fitly diſpoſed is not wanting, and the iudging Faculty at hande, and that nothing more is required vnto perfect ſenſe; it is not to be doubted but that Senſation may be abſolued in the organ and iudgement alſo giuen of the obiect euen vvhen we are faſt aſleepe. But the reaſon why we do not perceyue this Senſation, is, not becauſe we haue no ſenſe at all, but becauſe we know not that we haue Senſe.

Wee haue ſence in ſleep but know it not.

QVEST. X. *That by our outward Senſes we doe not know that wee haue Senſe.*

THat wee doe *perceiue* by the Organs of our Senſes is euident enough by that which hath bene ſaide, but it is doubtfull and vncertaine how wee ſhall know that we haue Senſe, ſeeing that this knowledge is not gathered from the externall Senſes: for whatſoeuer is *perceiued* by them muſt be their proper obiect, but Senſation is the obiect of no externall Senſe.

Moreouer

Moreouer the externall Senses know nothing but externall thinges : but the acknowledgement of Sensation is no externall but an internall thing : wherefore it cannot be *perceiued* by the externall Senses. Thirdly, if together and with the same Sense we should *perceiue* and take knowledge of this perception, it woulde then necessarilie followe, that the acte of *perceyuing*, and the obiect of Sense should bee one and the same thing, which how absurd it is I referre me to any man to esteeme. Lastly, we do not at the same time Perceiue and Iudge of that which we haue perceiued, but somwhat after the acte of Sensation we know that we did Perceiue : a manifest argument that the one is a diuers act from the other, and that with one Sense we do perceiue, and with another know that we did perceiue. But this may especially hence be conuinced, that blinde men though they do not see, yet they perceiue that they do not See : seeing therefore the Organes of their sight are vnfit for vision, it doth necessarily follow that it is by another Sense that they perceiue themselues not to see. Now if it be by another Sense that we know that we do not perceiue, surely it is another Sense also by which we know that we do perceiue.

We know not that we perceiue by Vnderstãding nor reason.

QVEST. XI. *Whence it is that we perceiue that we haue Sense.*

IF therefore none of the external Senses do performe this function, what may it be ? Is it the worke of our vnderstanding or of our Reason ? No : for this action is common to brute Beasts which be destitute of reason. For they know when they do not See, or Heare, or Smell and so in the rest. And that they know so much may easily bee gathered by their opening of their eies when they be shut, and pricking vp their Eares when they would See or Heare. Neither needs we wonder heereat, for they are enriched with some Functions that come nerer vnto reason it selfe, as I might easily proove by many instances of diuers creatures out of *Aristotle* and *Pliny* and other Historians if I thought it pertinent to this place. Seeing therefore vnreasonable creatures do know when they *perceiue*, that is, haue vse of their Sences, it followeth necessarilie, that that knowledge is not a worke of Reason.

It is no worke of the phãtisy

Neyther is it any worke of the Phantasie, in regard that it worketh after the act of *perceiuing* when the obiect is not present ; but this Sence ought to iudge, at least then when we haue vse of Sense, that we doe vse it, and after Sensation to doe nothing, whence *Aristotle* in the 136 Text of the third Booke *de anima* handling this matter affirmeth, that this is done continually in the first Sense. And this Sense is the common Sense, so called becaus it is proper to no one Sense, but is equally common to all ; for Nature hath alwayes endeuoured that shee may bring a multitude into an vnity so much as possibly may be : wherefore she hath ioyned in one common sence al the outward Senses, wherinto as lines going from the circumference into the center they may determine : & this hath the Philosopher verie elegantly declared in the 30. Text of his third Booke *De Anima*, and calleth this Common Sence the meane or middle betweene the external Senses, considering them as the Circumference and this as the Center. This is that Sence by which we know that we Heare & See and perform the functions of the other Senses : this is it which being bound in our sleep maketh vs ignorant of our Sensation : this is it which except it be present all the other Senses are vnprofitable : this is it which offereth to the Phansie the species which the outward Senses haue perceiued, and the phantasmes to the vnderstanding. In a word, this is it without which neither the externall nor internall Senses, nor the principall Faculties of the Soule could consist entire and absolute.

We know that we perceyue by the Common Sense.

QVEST. XII. *Of the Number of the Senses.*

That there be fiue Senses.

IT is receiued of all men that the Senses be fiue in number, but especially of *Aristotle* in the first chapter and 128 Text of his first Book *De Anima*, who sayth, that beside Sight, Hearing, Smelling, Tasting and Touching there can bee no other Sense assigned. And this is also confirmed by reason, beecause there be onely fiue Obiects ; Colours, Sounds, Odors, Sapors and Tactile qualities : if therefore there can be found no other proper obiect beside these fiue (I meane of externall obiects) it doth necessarily follow that there is no other Sence beside these ; so also becaus these fiue mentioned seuerall Obiects are so proper vnto their seuerall Sences, that none of them is iudged of but by his owne proper Sence : I say it followes hence that there are no fewer Sences then fiue, becaus the Obiects are full out fiue.

That there be fiue propper Obiects of the Senses.

The number of the Senses.

Furthermore, this number of fiue Sences is also confirmed by the number of the Elements, for *Aristotle* in the end of the second Chapter of his Booke *De Sensu & Sensili*

saith,

saith, that euerie organ is assigned to a particular Element, namely, the Eye to the water, the Hearing to the Aire, the Smelling to the Fire, the Touching to the Earth, and Tasting, because of his neere affinitie to Touching is resembled vnto the same Element.

Neither doth that which may be obiected any way infringe or impeach this opinion, to wit, because there is one onely Sensatiue Faculty therefore that there should bee but one sense: for the reason why the eie discerneth colours, the Eare iudgeth of soundes, the Nose perceiueth sauours, is not from the Faculty but from the temperature of the Organ; for the Foote also would see if it were endued with a temperament conuenient for the discerning of colours. That they haue Sense, the Organs haue it from the Faculty; but that they perceiue rather this then that Obiect, they obtaine it not from the Faculty but from the temperament of their Organ. Wherefore, whereas the Eye doth discerne of Colours, the Eare of Sounde and the Nose of odours, it is not because there is a certaine Visiue, an Auditory and odoratorie or Smelling Faculty, but because one and the same faculty carrying it selfe in euerie Organ after the same manner, doth diuerslie proceede into acte, according to the diuers temper of the diuers Organs. Obiection. Solution.

QVEST. XIII. *Of the order of the Senses.*

HAuing thus determined the number of the Senses: it followeth in the next place that we speake something of the order of them, to wit, whether wee ought to begin with the sight as *Aristotle* and almost all Philosophers do, or with the Touch which is a contrarie way wherein Physitians & Anatomists do walke, and these be the two contrary Sects concerning this matter of order, for none euer made doubt about the interruption or breaking off the order; but how manie Authors soeuer there be they haue either placed Sight in the first place, Hearing in the Second, Smelling in the third, Tasting in the fourth, and Touching in the Fift: or else on the contrarie haue put Touching in the first ranke, Tasting in the second, Smelling in the third, Hearing in the fourth, and Seeing in the fift and last place.

As concerning the first, it is the opinion of the Philosophers and of *Aristotle* especially, who, both in the second Booke *de Anima* and in the 2. 3. and 5. chapters of his Booke *De Sens. & Sens.* doth ranke them in this order. Moreouer this assertion seemeth to bee grounded vpon reason, because this is the order of the Elements which do concurre for a *Meane*, or other helpe to the Senses; so that euerie sense in respect of that Element vnto which it is appropriated, ought thus to be placed, and according thereto should their order and frame arise. Senses to bee placed according to the order of the Elements.

Sight is then the first of all the Senses, because Fire hath the first place among the Elements, for sight is fiery, both in regard of the Sense; for it hath an ingenite or inbred fire, as also by reason of the sensible thing, for except there were light which proceedeth from a fiery bodie, there would be no vision. The sight is fierie.

The Hearing is the second because it is aiery, for aire occupieth the second place: and the Hearing is airy both in respect of the Sense because it hath an inbred aire, and in respect of the Obiect, because the Sound is formed in the aire, so that it is of the Essence thereof. The Hearing is aiery.

Smelling is put in the third place, because as it is the middle betweene the other Sences, so it is appropriated to an Element (if I may so say) disposed in the middest of the rest. For that which is a *Meane* betweene the Nature of Water and aire as *Galen* doth well witnesse in the second chapter of his Booke *De Odor. Instrum.* falleth vnder the Sence of Smelling; because that which is neyther so thin or rare as aire, nor so crasse and thicke as water may well be concluded vnder the name of a Vapour. Now that Smelling is vaporous both in respect of the Sence it selfe and of the thing sensible, wee may haue occasion to prooue heereafter. Smelling is vaporous.

The Taste deserues the fourth place, because Water succeedeth Aire, and to water this Sence is referred, as wel because of the Communion of the Senses, as also in regard of the essence of the obiect. The Taste watery.

The last place belongs to the Touch, because the earth is in the last and lowest place, of whose nature and quality this sense of Touching doth participate. The Touch earthy.

QVEST. XIIII. *A conformation of the order of the Senſes.*

The order of the ſenſes proued by the conſtitutions of the organs.

THat the Senſes ought to be thus continuated among themſelues and propounded in this order, the conſtitution and conformation of the Organs doe giue vs ſufficient proofe: for the proper Inſtrument of ſight is vayled with a very denſe and thicke couer, that of the Hearing is more rare, that of the Smell yet thinner then them both, which *Galen* in the 6. Chapter of his 8. booke *de vſu partium*, hath very well obſerued, where ſpeaking of this Senſe, hee ſaith, *If the couer were ſo framed, that it might be no hinderance to the Senſe, then it ought to be ſo much more rare then that of hearing, by how much the obiect hereof is of more craſſe parts then that of the eare.* The couer of the Taſte is not onely more rare, but it is altogether ſpongie, as we haue ſhewed before in the membrane of the Tongue. Laſtly, the couer of the Touch is moſt rare of all.

Parts.

And by the tenuity & craſſenes of the obiects.

This order is moreouer confirmed by the qualities of the Obiects, for the Obiect of the Sight is the thinneſt & fineſt of all the reſt, yea after a ſort ſpiritual & not corporeal. That of the hearing is more craſſe, and the Obiect of Smell yet more craſſe and thicke then either of them: where-vpon *Galen* in the aboue-named place witneſſeth, that the Obiect of the Smell is of more groſſe parts then that of the Hearing: for ſaith hee, *by how much the ayre is exceeded by the light in the tenuity of their parts, by ſo much is the vapour ſurpaſſed by the Ayre.* The Obiect of Taſte is much more craſſe then the former. But the Touch being earthie, muſt needes bee the moſt craſſe of all. Finally, this muſt needes bee the order of the Senſes, in reſpect of the *medium* or *meane*; for the Sight aboue all hath neede of a meane, but Hearing hath leſſe neede, and the Smell leſſe then it. Taſting is as ſome thinke without any meane at all, but eſpecially the Touch as wee haue partly prooued already, and haply it will againe fall vnder our diſcourſe.

And by the neceſsity of the *medium* or meane.

Laſtly, the Poſition of the Inſtruments are a confirmation of this order: for the organ of Sight is placed without, but the organ of the Eare is a little more inner, and the inſtrument of Smelling more inward then them both, that of the Taſte is yet more hidden, and the Inſtrument of Touching is called by *Ariſtotle* τὸ ἐντὸς ὤν, that is, *exiſting within.* By theſe demonſtrations therefore is this continuation and order of the Senſes ſufficiently confirmed, to wit, becauſe euery one ought to be placed in this aſsigned rank. The Sight and Touch be the extremes becauſe they are moſt diſtant one from another, by reaſon that the obiect of Touch is corporeall and materiall, and the obiect of the Sight incorporall and ſpirituall; the Organ of Touch is placed within, but the Organ of Sight without; the Organ of Touch is couered with a moſt rare and thin vaile that of the Sight with a moſt denſe and thicke couer, becauſe Sight vſeth a Meane, but Touch none at all. Laſtly, the Touch is earthy and the Sight is fiery. The Hearing and Taſting are leſſe diſtant one from another, and the Smell is equally affected to all, and therefore by good right challengeth the middle place.

QVEST. XV. *The arguments of the Philoſophers.*

ALthough thoſe things which are alleadged in the precedent Chapters, ſeeme to proue nothing elſe but the rank or following order of the Senſes, and if any thing doe inferre a concluſion, it is onely probably, yet there be which doe contend for the primacie of the ſight with ſtrong arguments.

Sight is by nature before the other ſenſes.

And firſt, they ſay that Sight is the firſt by Nature, as *Ariſtotle* witneſſeth in the 7. Text of his 2. booke *de Gener. et Corrupt.* Wherefore if wee will obſerue the order of Nature, we muſt begin with the Sight.

And more noble.

Secondly, that which is more noble then the reſt, doth deſerue the firſt place. But Sight not only in reſpect of the Senſe, but of the Organ alſo, yea of the *meane* and obiect doth excell all the other in dignity. To theſe we adde, that ſight is more liable to our vnderſtanding, and therefore we are to treate of it in the firſt place, becauſe many things are found in it more facile and eaſie which alſo may prepare the minde vnto the knowledge of the other Senſes: for the Organ thereof is very conſpicuous; the *meane* is manifeſt, the obiect is cleare and other things which in the reſt of the Senſes bee very obſcure are perſpicuous and knowne in this: neither is it a ſufficient obiection to ſay, that in reſpect of the act of *perceiuing*, this Senſe is moſt hard and difficult to be vnderſtoode.

QVEST.

QVEST. XVI. *The Arguments of the Physitians.*

WE come now vnto the reasons which are brought for the confirmation of this opinion both of *Plato*, of *Galen* and of the Anatomists, and they are taken partly out of *Aristotle* and partly out of the propriety of order. For *Aristotle* in the 37. Text of his 1. Booke of Physicks: teacheth that we must begin with those which bee most common; both because (as *Auerhoes* expounds it) those things which be most common are best knowne, and also because the affections which are to bee declared doe primarily agree vnto them: and lastly, least wee should too often fall into *Tautologies*, or vaine repetitions. And *Aristotle* himselfe giues an excellent reason of this his owne Position, to wit, because without the knowledge of those things which be more common, the lesse common cannot be knowne.

Why we must begin with those which be most common.

Now who will denie that the Sense of Touching is more common then the rest of the Senses? vvho knowes not that this Sense is common to all liuing creatures? yea it is so common in all, that without it no Sense can bee performed; in so much that the same *Aristotle* confesseth that euery Sense is a kinde of Touching. Beside, Art being the Ape or imitatour of Nature, we therefore in the tradition of our Arts should follow the order of Nature, in which order we must begin with those which are first (not in intention as the former Sect affirmeth) but in originall and generation: wherefore according to the order of Nature Touch seemeth to be put in the first place. To these wee may adde, that this Sense is more knowne then the rest, for a man hath this sense more exquisite then any of the rest; and it doth of necessity follow, that that Sense which we enioy most exquisitely, thereof we should also haue most certaine knowledge.

Touch is the common sense

Touch according to the order of nature is the first.

QVEST. XVII. *The Authors owne opinion.*

THough both these Sects haue some shew of difference, yet in my opinion they may be reconciled, so that neither of both may seeme any whit blame worthy, in regard that they contend about a matter which is of no great moment, their strife being not about demonstratiue grounds. But because the Schoole of Physitians hath alleadged the more waighty arguments, I will more willingly cast in my lot with them. Yet may any man draw a reconciliation betweene them from the diuers consideration of the order. Some follow the order of Nature in their writings, which order may be vnderstoode to be double, to wit, either the order of originall, or of intention, that is, either by what order Nature doth worke, or what end she presenteth to her selfe in her worke. According to the former consideration the end is the last, but according to the latter it is the first.

A diuers consideration of order.

Againe, some in their deliuerie of Arts follow that order whereby the Art is more easily taught, as for example, some things that come behinde cannot be vnderstoode vnlesse some other things bee præmised before. Others obserue the order of dignity; so that by this diuersity of order being conferred with that which we haue said before, it may easily be gathered what we ought to conclude of either sect.

QVEST. XVIII. *Whether the Senses doe neede a Medium or Meane.*

IT seemeth to be no hard question to determine whether the Senses need a *Medium* or Meane; because out of *Aristotles* Philosophy wee haue as it were an Oracle, 1000. times repeated that *The Obiect placed vpon the Sense doeth make no Sensation*: especially seeing hitherto it is receiued for such an vniuersall principle and ground, that hee which denyes it deserues not to bee confuted. But weighing this as all other Theormes in the equall ballance of Reason, I am bolde to demaund whether this position deserue the Title of a *Principle*? As for *Aristotle* he acknowledgeth it indeede for a principle, and in many places resolueth vppon it for an infallible and vndoubted axiome without adding any reason thereto: but whether herein he hath well done, and whether it be such a ground and principle or no, it will appeare by the due consideration of the conditions required in a principle.

An axiome questioned.

The first condition therefore of a Principle is (as it appeareth *ex posterioribus Analyticis*) that it may be truely affirmed of euery particular of the same kinde, and in my iudge-

Touching and Tasting without *Medium.*

ment sayeth *Placentinus* this axiome transgresseth this condition, because it agrees not to euery Sense to haue a *Medium*, for that Tasting and Touching are absolued without.

The reason why the other are not.

But some may haply doubt how these two Senses can be perfourmed immediatly, and yet a *Medium* be required to the rest. The answere is at hand; because the organs of some Senses are so sensible that they would easily bee offended with the contaction of their obiects. So the Sight will not admit of the Touch of any thing, and a vehement motion whereby the sound is generated would offend the organ of Hearing, if it should come immediatly vnto it.

Againe, a fumid exhalation which falleth in with the Sence of Smelling would hinder Respiration, and except it were transported through a *Medium* or Meane, it would bee offensiue and hurtfull to the Organ.

Some Senses perceiue materially others spiritually, as Sight.

Lastly, some Senses doe *Perceiue* their obiects not Materially but Spiritually. Now the *species* must be drawne from the obiect through a *Medium*. Some also receiue them Materially, and those haue neuer a *Medium*. For a colour cannot really attaine to the organ, because an accident out of his subiect is nothing: whereupon it followeth that not the *Colour* placed aboue the eye doeth offend it, but the *coloured* or subiect of the colour. But put case that Colour could really without any dammage bee impосed vpon the Eye, yet it would not moue the Senee; because it would condense and thicken the eye: for by this immediate contaction the colour doeth worke vppon the *Daphanum* or that which is translucent.

Not the colour, but the coloured offends the eye.

The Touch therefore and the Taste haue no neede of a *Medium*, because they doe not receiue Intentional or abstracted *species* but reall qualities; for if they should receiue Spirituall formes then they must discerne of them a farre off without the contaction of the obiects; for the *species* are diffused into an ample distance; but the Tast and the Touch are not perfected without contaction.

The Taste and Touch receiue reall qualities.

We see moreouer in these Senses reall affects of the obiects, which could not be vnlesse they should be *perceiued* really: but these thinges shall bee more at large discussed in their proper places.

For a playner dilucidation of the trueth, wee must obserue that all Senses haue not alike neede of a *Medium*; but there is a certaine order and degree of this necessity. For the Sight doeth especially neede a *Medium*, because it is most of all Spirituall, and there is no Sensation at all of a reall colour immediatly placed vpon the eye.

The Sight doth especially neede a *Medium.*

A *Meane* is also requisite to the Hearing, yet it hath lesse neede thereof then the Sight, for a sound imposed vppon the Hearing maketh a kinde of Sensation, but very imperfect, namely such an one as is offensiue to the organ.

The Hearing lesse.

The Smelling yet lesse.

The Smell in like manner hath vse of a *Medium* if the smoaky exhalation be vehement; for so it may hinder the Respiration and hurt the organ: yet an odour may bee *perceiued* without a Meane. VVhereupon when we would *smell* any thing perfectly we hould our noses close to it: so that the *Smell* seemeth to be in the middle betwixt those *Senses* which neede a Meane and those which are performed without it.

Tasting and Touching none.

Taste also though it bee made by contaction yet requireth necessarily an humidity, which may bring the Sapors out of *Power* into *act*. But Touching hath need of nothing saue the contiguity of the tactile body, beeing performed without the helpe of any other Meane. And thus I thinke it is plaine what we may determine of this question.

QVEST. XIX. *What the Medium ought to be and of what kinde.*

AFter we know which of the Senses doe need a *Medium* it followeth that wee make inquiry to find out what this *Medium* is & how it ought to be affected. And herein we must first obserue that the *Medium* ought alwayes to be present; least when all thinges else requisite for Sense bee fitly disposed, yet for fault of a *Medium* we bee made lesse able to performe this act of Sensation.

Fire is not the *Medium*, but Ayre.

VVherefore the *Medium* by whose interposition wee *Perceiue* is not Fire, for this is not alwayes at hand but Ayre, for this doeth alwayes encompasse vs about, it is alwayes present, in it we leade our liues.

2. Reason why the Ayre is the *Medium*

Secondly, this *medium* should alwayes consist in a middle place betwixt the Organ and the obiect; for hence it hath the name of a *medium*, yet so, that it touch both the Organ and the obiect, for otherwise it could not performe his office. But there is no Element which is continually contiguous with our Organs but the Ayre. Thirdly, it is necessary

ceſſary that this *medium* be voyde of all ſenſible qualities, for otherwiſe it would bring the obiect adulterated or defiled to the Organ and affect the Senſe with a proper quality of his owne: VVherefore no compounded body is fit for this function, becauſe all compounded things are ſenſible of themſelues. The conditiõ of a *Medium.*

If you obiect that there be no Elements exquiſitely pure, and that therefore none of them can be a fit *medium* being themſelues ſenſible. I grant indeede that no Element that is neere vs is perfectly pure, yet that Ayre that is neere vs wherein we liue doth exceed the reſt in puritie, and is cleare from all qualities except Tactile, ſo that it may be accounted for a *medium* to all the reſt of the Senſes except the Touch. agreeth with no element except Ayre.

And is there then one *medium* ſeruing to all the Senſes?

Yea, for this is the concluſion which is inferred from the former premiſes, to wit, becauſe this alone is moſt pure, and is alwayes preſent with vs, this alone is continually in the middeſt betweene the Organ and the obiect, this is alwayes cloſe adioyning and touching both the Organ and the obiect. The Ayre therefore alone ſerueth for a *medium* to the Sight as it is Traculent; to the Hearing as it is ſounding; to the Smell as it is capable of odours.

But it may be obiected, that if the Ayre be the onely *meane* of the Senſes, then would it follow that Fiſhes which liue in the water haue no Senſe.

I anſwer, that for their ſight the water ſerueth for a *medium*, but other Senſes they haue none (ſaith *Placentinus*) ſauing their Taſt and Touch, and theſe two haue neede of a *medium*, yet they haue theſe Senſes alſo but imperfect; but if any man will yet more inſtantly vrge, that they haue the Senſe of hearing, we grant they may heare but moſt imperfectly, and for ſuch imperfect ſenſation the water ſerues in ſteed of a *medium*; but we ſpeak here of perfect Senſation, where as the Senſation of Fiſhes is not ſimply perfect, but only in their owne kind, to wit, ſo farre foorth as they haue need of it.

Laſtly, this condition of the *medium* is required to the perfect performance of Senſe, namely, that it bee not too ſpatious or ample, and alſo that it bee not too narrow or little. But what is the limit or extent of this *medium*, that is, how farre or wide it ought to extend it ſelfe, is impoſſible to be determined, for this limit or extent muſt almoſt infinitely be varyed according to the magnitude, paruity and vehemency, as alſo according to the vigor & ſtrength, or imbecillity and weakeneſſe of the Senſe: For we doe not diſcerne Mountains, Cities and whole Countryes but a farre off, and leſſer things wee do not ſee except they be neere at hand. So we doe not perfectly and without offence to the Organ heare a vehement ſound, except there bee a great diſtance betwixt the Sence and the obiect; nor a low voyce except we be neare vnto it. And the ſame reaſon is of the reſt. The termination of the *medium* is diuers.

QVEST. XX. *What an Obiect is.*

AN obiect or that which is ſenſible, *is a quality which mooueth the Organ, and is iudged of by the ſenſatiue facultie.* And although that which is *ſenſible* bee two fold, proper or common, yet I conceiue this definition to be peculiar to the proper obiect; vnleſſe haply it may agree to ſome of the common, & therfore we will ſeuerally define them both. An obiect is twofold.

Proper obiects, therefore as *Ariſtotle* witneſſeth in the 63. text of his ſecond booke *de Anima*, are thoſe *which cannot bee perceiued with any other ſenſe, and about which the ſenſes in diſcerning are not deceiued.* And this definition by it ſelfe agreeth to the thing defined. What a proper obiect is.

For in that ſometimes the Senſes erre about their proper obiects, it hapneth not of themſelues but from ſome accident; to wit, from the deprauation of ſuch things as doe concurre to this ſenſation; as for example, when all things appeare yellow to thoſe that are ſick of the Iaundies, this hapneth becauſe the Eye is tainted with the yellow colour of choller; and when aguiſh men do iudge ſweet things to be bitter, it comes alſo from choller wherewith the Tong is affected, and that is from euent & accident, not from the proper condition of the Senſe. VVherfore ſeeing that when ſuch impediments or lets are remooued and the obiect *medium* and Organ are naturally diſpoſed, the ſenſe cannot bee deceiued about his proper obiect, it is by good right thus abſolutely defined. The Senſe is not deceiued about his obiect.

For the number of theſe obiects, they are as many as are the Senſes, for colour is the obiect of Sight, Sound of Hearing, Odours of Smelling, Sapours of Taſting, and Tactile qualities of Touching. How many proper obiects there be.

What a common obiect is

Common obiects are those, *which are perceiued, not of all the Sences as some would haue them, but of more sences then one.* Which *Aristotle* teacheth very well in his booke *de sensu et sensili* where he affirmeth, that they are therefore called common obiects, because they are common though not to all the senses yet at least to the sight and touching, for by these two are all things perceiued, though not after the same manner as their proper obiects, to wit, by sending a species from them, or by attaining really to the Organ; but as it were certaine manners and conditions ioyned with the proper obiects *in order* vnto the motion of the sences: so that they doe not absolutely and primarily moone and affect the sence, but onely together with their proper obiects. And beeause the second doe not worke without the first, therefore the common obiects are not *perceiued* by the externall sence without the proper. And these common obiects are fiue in number according to *Aristotle*, Motion, Rest, Figure, Magnitude, and Number.

When the cõmon obiects moue the sense.

QVEST. XXI. *Of the Organs of the Sences.*

What an Organ is.

THE Organ or Instrument of the Sence as *Aristotle* witnesseth in the 122. text of his second booke *de Anima*, is that *wherein the power and force of perceiuing is seated.* And this Instrument is the eye in the sight, in the hearing the eares, in the smelling the nosthrils, in the taste the tongue; and for the touch, though all the skin yet especially that of the hand. But yet the vertue or faculty of sensation doth not reside in the whole Organ, but in some certaine similar particle, of which kinde is the Cristaline humor in the eye, the nerue of hearing dilated in the Eare, the mamillary processes in the Smell, the proper flesh or pulpe of the Tongue in the Taste, and in the Touch the true skin; the other parts of the Organs assist this particle, keeping it as it were in tune, or preseruing the harmony thereof from the offence and incursion of outward iniuries; for otherwise this sweete musicke, consent and proportion, would by the ouer-vehement force and change wrought by excessiue obiects be destroyed, which concordance being broken there can be no sensation.

And thus much shall suffice to be spoken of the Sences in generall; we will entreate more at large of the particular Sences in their proper places, where also wee will note some things concerning their Organs which will be worthy your obseruation. And first of the Sight according to the order we before obserued in our Anatomicall History.

QVEST. XXII. *Whether sight be made by Emission or Reception, where the nature of the sight is accurately explaned.*

OVR particular controuersies concerning the Sight shal begin with that notable question cõcerning the nature & maner of vision or sight, which is indeed rather Philosophicall then belonging to the art of Anatomy; notwithstanding beeause *Galen* hath elegantly ventilated it in his books *de vsu partium* & *de Placitis Hip. et Plat.* it shall not bee altogether impertinent to insert some collections in this place which yet wee must fetch out of the secret mysteries of Philosophy.

Three different opinions concerning the nature of sight

There are three especiall or most notable opinions of the Philosophers concerning the manner of sight. Some thinke it is made onely by emission of something out of the eye: others only by Intromission or Reception of something into the eye: and the third sort contend, that it is made partly by Emission, partly by Reception or Intromission.

The first opinion of emission

Of the first sect there be diuers Authors but all of them disagreeing among themselues. The maysters of the opticks thinke that certaine beames do issue from the Eyes and reach vnto that which is to be seene: the figure of which beames they conceiue to bee pyramidall, the Cone or point whereof is in the eyes the Basis in the thing to bee seene. *Pythagoras* thought that sight was made by an emission of light out of the eye vnto the obiect; which light is reflected againe vnto the eye, euen as a hand-bal strucken against a wal doth rebound backe from the wall vnto the hand with an equall force.

The masters of the Optick Arts. *Pythagoras.*

Empedocles.

Empedocles, *Hippocrates* and *Nicus* thinke that sight is made not by Emission of light onely, but of beames also. *Plato* thinkes that the eye sendeth not any beames foorth of it but onely light, and that it also reacheth not vnto the thing seene, but vnto a certaine or proportionable space of the *Medium*. *Democritus*, *Lucipp.* and the Athenian *Epicurus* conceiued that certaine Images or formes did flow from al things through the Motes which be in the ayer. *Chrysippus* and the whole Schoole of the Stoicks, thought that a certain

Democritus. *Chrysippus.*

spirit

ſpirit aſcended from the heart vnto the Aple of the Eye, which ſpirit was extended as farre as the obiect. And theſe are the different conceits of the Authours of the firſt opinion whereby it is ſuppoſed that ſome thing is ſent out of the Eye vnto the viſible obiect, which opinion the Platoniſts confirme by theſe reaſons.

The *Platoniſts* Arguments.

Firſt, they ſay that witches doe faſcinate or bewitch onely by beholding one with their Eyes, whence it is that the Poet ſayth:

Neſcio quis teneros oculus mihi faſcinat agnos.
I wot not well what witching eye, My tender Lambs hath done to die.

Secondly, they ſay that a Baſiliske doth infect a man, onely by ſeeing him.

Thirdly, that a menſtruous woman doth infect a looking glaſſe as it were with ſome materiall corruption.

Fourthly, that if a Wolfe behold a man he will become hoarſe.

Fifthly, that *Tiberius Cæſar* is reported to haue aſtoniſhed a ſouldior onely by caſting his Eye vpon him.

Sixthly, that *Antipho* (as *Ariſtotle* reports in the third booke of his Meteors) had his owne image euermore before his eyes.

Seuenthly, if we did not ſee by emiſsion how it comes to paſſe, that when wee would ſee more exactly wee draw the Aple of our Eye into as narrow a roome as wee can, Is it not to this end that the beames and ſpirits going out of our eyes may be more vnited.

Eightly, if no thing were ſent foorth of the Eye, how could the Eye be ſo weary with continuall looking.

Ninthly, if viſion were made by reception and not by emiſsion, wee needed not to conuert our Eye directly to the viſible obiect, for wee ſhould ſee whether wee beheld the thing or no.

Tenthly, we could not ſee the magnitude or figure of many things, for the Eye being ſo little a body cannot receiue ſuch great obiects into it ſelfe.

Eleuently, if it were by reception, then would it follow that the more we dilated, the Aple of our Eye, the better we ſhould ſee, becauſe our reception would be large.

Twelftly, diuers or contrary ſpecies or formes would together and at the ſame time be receiued into the ſame Eye, becauſe at once it doth behold two contrary obiects, as blacke and white.

Laſtly, the leaſt thing ſhould bee as eaſily perceiued as the greateſt, the contrary whereof is manifeſt, for the ſharpe point of a needle held vpward to the skie is not perceiued, becauſe the beames being ſeparated cannot meete in one, by reaſon of the paruity of the obiect. But if wee would ſee it, we muſt of neceſsity withdraw our ſelues to the one ſide.

The opinion of the Peripateticks that ſight is by reception onely Their arguments.

To conclude, the Eyes are of a fiery nature, for they are both pyramidall and continually mooueable and neuer ſtiffe, but it is the property of fire, alwayes to ſend ſome thing from it, as light, flames or heate. Theſe be the principall reaſons of the Platoniſts, and of the maiſters of the Opticks.

Let vs now lend our eares vnto the fautors of the other ſect. The prince of which company and opinion is *Ariſtotle* in his ſecond booke *de anima*, and in his booke *de ſenſu & ſenſili*, and his ſteps haue all the Peripateticks followed as *Alexander*, *Themiſtius*, *Auerrhoes*. And theſe thinke that *Sight* is made onely by reception of ſome thing into the Eye, and not by emiſsion of any thing forth. And that for theſe reaſons.

Firſt of all, becauſe that ſeeing Senſe is a paſsion it ought only to bee made by reception. So Hearing is made onely by the reception of ſounds. The Smell by reception of odours. The taſt of ſapours and the Touch of tactile qualities.

Moreouer, they that haue more moyſt and humide eyes do alwayes conceiue the obiects to be greater then they are, becauſe the ſpecies are repreſented in a greater ſhape, by reaſon of the humiditie.

Thirdly, an ouer vehement obiect doth hurt the Senſe.

Fourthly, we ſee in a looking glaſſe the image of the thing oppoſite vnto it, which we could not doe vnleſſe the image of the thing were carryed from the obiect vnto the *medium* and ſo vnto the glaſſe.

Againe *Ariſtotle* in the third ſection of his Problemes asks the queſtion why the right eye ſhould with more agility performe his function then the left, and yet the Eyes and eares

Eares do both of them see and heare alike. He answers, that those Faculties are performed by doing, these by suffering, and that Both the Senses and their Organs do equally suffer.

Sixthly, Oldmen discern better of such obiects as be a farr off then of those which bee neere and that not because of the light, or the beames or spirits sent forth of their Eyes, for they are very small, impure and darkeish; but because the species or forme co mming from a remote obiect is made more slender and spirituall and more apt to be receiued into the Organ.

Seuenthly, The smallest Starres in the cleare Winter may bee discerned and not in Summer, because their species or formes beeing receiued into a crasse and thicke Ayre are there terminated and multiplicated: but in Summer by reason of the raritie and thinnesse of the Ayre they cannot be receiued terminatiuely or definitely (for of necessity we must vse our Schoole terms to expresse these matters of Art) neither yet be sufficiently multiplyed that they should attaine vnto our sight.

Galens opitiõ. Out opinion that sight is made by reception.

Galen in the seuenth Chapter *de placitis*, and in the tenth, *de vsu partium*, to the end that hee might reconcile the *Platonists* with the *Peripatetickes* determineth that Sight is made partly by Emission partly by Reception. Truely for my owne part I reuerence *Galen* as a Master, and hee stands in no neede of my patronage or approbation hee is sufficient of himselfe, yet as he was often wont to say, *vincat vtilitas*, let profit preuaile; so wee say also, *vincat veritas*, let Truth preuayle. I had rather therefore thinke with *Aristotle* (whom I esteeme and respect as another Nature, but an Eloquent Nature) that vision is only made by Reception of species and that nothing is sent foorth of the Eye vnto the thing seene which may helpe the Sight, that is neither beames, nor light, nor spirit. The truth of this opinion may be strengthned with these reasons.

The 1. reason That the Organ of sight is watry & why.

First, the Organ of Sight is watery; now it is the property of water to receiue: that it is watery may bee thus demonstrated. The Organ of Sight ought to bee Tralucent that there may bee a kinde of Analogie or pro portion betweene the obiect, the meane, and Organ, that is, betwixt the Agent and Patient. But of shining and cleare bodyes some are rare and thinne, others more dense or thicke. The rare bodyes doe easily receiue the species or images but they doe not retaine and hold them; so the Ayre is full of species, but they presently vanish away and are not perceiued by reason of the rarity therof nay and I say, that such species cannot be discerned in a glasse except they be retayned by lead or some such like dense and thicke body. That therefore these formes of visible things may be held and retained in the Eye, there is required both a transluceut and thicke body; and of this kind is water, for fire and ayre be cleare indeed but rare. The Organ therefore of Sight is watery, of which nature also are the principall parts of the Eye.

The 2. reason which is *Alexanders*.

I will now produce a very elegant argument of *Alexanders*, which is on this manner. That which is sent forth of the Eye is either corporeall or incorporeall. But it is not incorporeall, because incorporeall things can neither issue foorth of the Eye, nor change their place, nor be in the Eye as in a place. It is not corporeall because then the Eye in one day would vtterly be destroyed, neither could it in a moment bee carryed as farre as the skie because that no corporeall substance is mooued in an instant.

To these we adde, that when the winde doth blow it would bee dissipated, and so there would be a Penetration of bodyes which is against Nature. Now if you should thinke that the Ayre would giue place to that corporea l substance going out of the Eye, there could be no Sight at all, because there would bee no continuation of those beames with the Eye but some body would interpose it selfe betwixt them.

The solution of the Platonists reasons.

As for those arguments which the Masters of the Optickes and Platonists oppose against this truth, we will thus in order answer and repell them.

First we deny that fascination or bewitchiing is done onely by sight: except it be by magicke Art.

For the second and third, we also deny that a Basilisk or menstruous womando by their lookes infect any thing, but it is by reason of a certain corrupt and poysoned vapor which breatheth out of their mouth, eyes, nosthrils and from their whole body, which by continuation and succession doth infect thr Ayre.

Fourthly, that which they obiect concerning VVolues, is more worthy of derision then of confutation.

As for *Tiberius*, he did not astonish his souldiour by any beames proceeding from his Eyes, but by his horrid and fearefull looke and countenance.

Sixthly,

Sixtly, as for *Antiphon* it is well knowne he was a foole, and therefore the fault of the occurſation of his image or reſemblance alwaies before him was in his braine not in his eies.

Seauenthly, we doe anguſtate or ſtrayten the apple of our eyes, leaſt by the external light our internall ſpirits ſhould be diſsipated.

Eightly, the Eye is wearied with looking, by reaſon of that force and endeuour which the faculty vſeth to adminiſter for the eſtabliſhment or fixing of the eye.

Ninthly, the Eye muſt bee conuerted or turned toward the viſible obiect, becauſe there can be no viſion but by a right line.

Tenthly, the magnitude of a thing is not receiued into the eye, but onely the *ſpecies* or forme of it, which becauſe it is a thing immateriall, may be wholly receiued into the eye.

To the eleauenth wee ſay, that the dilatation of the apple of the Eye doeth exolue or ſpend the ſpirits which are of abſolute neceſsity for the reception of *ſpecies*.

To the twelfth thus; both white and blacke colours may at one and the ſame time be receiued into the Eye becauſe they are receiued onely by an intentionall and incorporeall ſpecies or forme.

Laſtly, the poynt of a needle is therefore not perceiued, becauſe it is not a proportioned obiect to the Organ. By theſe it is plaine and manifeſt, euen to the dulleſt apprehenſion, that viſion is performed not by emiſſion or ſending forth any thing from the Eye but onely by reception of the ſpecies into it.

But the Nature of this reception is moſt obſcure and folded vp in many ſecret difficulties; for the enodation whereof, that this ſecret may appeare euident, foure things are to be diſcuſſed of vs. Firſt what it is that is receiued. Secondly, where or into what part of the Eye this reception is made. Thirdly, when it is made. Fourthly, how it is made.

Foure things to be obſerued in this reception.

As concerning the firſt queſtion *Democritus* and *Lucippus* thinke that corporeall obiects are receiued. *Epicurus* ſuppoſeth onely the beames of the viſible obiect are receiued. *Alexander* that the image onely of the thing is receiued, not as it were in a ſubiect, but like as in a glaſſe. We agreeing with *Ariſtotle*, thinke that onely the ſpecies or images are receiued, and that the quality of theſe ſpecies is incorporeall, immateriall, indiuiduall, the Phyloſophers call it *Intentionall*; which is produced in the *medium* or *meane* and Organ, and ſo multiplyed by a ſimple effluence or emanation as light proceedeth from the Sunne and a ſhadow from a body. This ſpecies, I ſay, is not it ſelfe ſeene; but it is that whereby we ſee, for onely the obiect is ſeene.

What it is that is receiued.

That onely the ſpecies are receiued.

The Eye therefore may very well bee compared to a looking glaſſe receiuing into it the Images of ſuch things as are obiected and ſet before it. For a glaſſe doth receiue all the ſpecies, not ſending any thing forth: yet in this doth the Eye differ from a glaſſe, that there is no vertue of the Soule in a glaſſe which can referre and tranſmit the image receiued vnto any other thing as it were vnto a Iudge.

The Eye is like a looking glaſſe.

But ſome will haply demand here, if the ſpecies or image receiued be immateriall how can it affect the ſight by ſeuering or gathering together of the ſpirits?

I anſwer, that the Eye is not affected by the ſpecies, but by the colour, according as it is more or leſſe ſplendent or enlightned, for all enlightned things do diſſipate, by reaſon that our ayry and ſplendent ſpirits do vaniſh into that light which is like vnto them: So white things, becauſe they haue much light doe diſſipate the ſpirits, but blacke doe gather them becauſe they are contrary to the ſpirits. So when night comes the heate is recalled from without inward, and as *Galen* teacheth in his Commentary vpon the 15. Aphoriſme of the firſt ſection, we ſleepe longer in winter becauſe the nights are then the longeſt.

VVherefore lucide and white obiects doe hurt the Sight, yea ſometimes they make a man blinde, becauſe the viſiue ſpirits being drawne out, and as it were intiſed by that which is like vnto them, doe breake foorth of the Eye with ſo great a violence and force that by ſuch irruption, either the ſubſtance of the Criſtalline humour or the coate thereof or ſome thing elſe in the Eye (which hath many tender parts) is either broken, or at leaſt ſuffers ſome alteration.

It will be againe obiected, if the reception of the ſpecies be immateriall, why ſhould the Eye be wearyed with continuall ſeeing? why do not prominent and goggle Eyes ſee better then other, becauſe they are more apt for reception.

I anſwer, that the Eye is wearyed, not by the impreſſion of ſpecies, but by the force and endeauours which the facultie vſeth to doe his worke, which is eſpecially to firme the

eye

Eye or hold it ſtedfaſt and to containe the ſpirits;but thoſe that are goggle eyed haue not ſo good ſight, becauſe their animall ſpirits are diſsipated, which are eſpecially neceſſary vnto the Senſe of Seeing, that being ioyned with externall light they might tranſmitte the ſpecies vnto the interiour ſenſe.

Of the place of this tecception.

The ſecond propoſition was concerning the place of this reception, to wit, into what part of the eye the ſpecies be receyued. And heere it will not bee in vaine to examine the different opinions of Phyſitians and Philoſophers. Some thinke that they are receiued into the ſubſtance of the Braine, grownding vpon the doctrine of *Galen*, who teacheth that all ſenſe is from the Brain. *Ariſtotle* ſaith, they are receyued into the *Pupilla* or Apple of the Eye, vnderſtanding by the Apple the Criſtalline humor. *Galen* ſaith ſometime into the Criſtalline, ſometime into the Cobweb-coate, which he ſaith is ſmoother and more polliſhed then any Looking-glaſſe.

Ariſtotle.
Galen.

Auicen ſayes, they are receiued in the meeting of the Opticke Nerues, and hence it is (ſaith he) that the obiect appeareth ſingle, becauſe the viſible formes are vnited in that coition or coniunction of the Optickes. We determine that they are receiued into the Criſtaline, becauſe it is the principall and primary Organ of Sight, placed in the very center of the eye, and differing from all the other parts in ſubſtance, figure and qualities. But if you would reconcile all theſe, then ſay, that the *reception* is made in the Criſtalline, the *refraction* in the coates, the *perfection* in the coition or meeting of the Optickes, the *perception* and iudging in the Braine.

Auicen.

Of the time of reception.

Concerning the time of this reception which was the third queſtion; all do agree in one, that viſion is made together with the perception of the ſpecies; but this perception is made in an inſtant, for the heauen is ſeene all at once, becauſe the light which produceth or bringeth foorth theſe *viſible ſpecies* doth diffuſe it ſelfe, and tranſporting them together through the aire placeth them in the extreme ſuperficies thereof that is next of all to the eye-lid, ſo that when the lid opens preſently the ſpecies is offered to the *pupilla* or Apple, and in a moment of time is ioyned therewith.

Of the maner of reception.

Laſtly, the manner of viſion is thus, It is made by the reception of ſenſible ſpecies not of bodies, which ſpecies although they ſeeme to haue ſome taſt of the condition of their owne matter, notwithſtanding they are not carried materially and as bodies are carried, but like the ſhapes or Images of bodyes, brought from the aſpectible obiect vnto the *pupilla* through the aire as a meane by right lines vnto an acute angle. Hee that deſires to heare more of the manner of viſion, let him reade *Alexander* and *Simon Simonius*, a man both for Phyſicke and Philoſophy very excellent, Commenting vpon *Ariſtotle* his booke *De ſenſu & ſenſili.*

QVEST. XXIII. *Whether any thing within the Eye may be ſeene, and whether it may be ſeene by it owne proper forme or by another, where alſo are explained ſome things concerning the nature of Suffuſion and of viſions or Apparitions.*

Whither anie thing within the eye may be ſeene.

HAuing reſolued that ancient queſtion concerning the manner of Viſion, we will proceed to the reſolution of two other doubts, that ſo there may be nothing wanting that can be deſired to the perfect nature of this ſenſe of ſight. The firſt therefore is whether any thing which is within the Eye may bee ſeene: then whither that which is ſeene, is ſeene by his proper Species or by another.

The 1. reaſon

That nothing within the Eye is viſible may bee thus demonſtrated. *Ariſtotle* in his ſecond Booke *De anima* writeth, *Senſile poſitum ſupra ſenſorium ſenſationem non facere, A Senſible Obiect placed aboue the ſenſorium or organe doeth not perfourme anie Senſation.*

Secondlie, if anie thing ſhould bee ſeene within the Eye, then woulde it follow that the Obiect and the inſtrument receyuing the Obiect ſhould bee the ſame.

Thirdlie, the Philoſopher teacheth, that there be three things requiſite and neceſſarie vnto the Senſe of Sight, the *Obiect*, the *Medium* or *Meane* and the *Inſtrument.*

Laſtly, Viſion is made by the reception of ſuch ſpecies as are produced and multiplyed in the aire; but if any thing within the eye ſhould bee ſeene, the ſight would not bee made by the ſpecies, but by a reall obiect.

To

To these we will adde that it would also follow that the grapy membrane which is diuersly coloured would be seene, but that is not seen: wherefore we conclude that nothing within the eie can be seen.

That something within the eie may be seen.

Now on the contrary, that something within the eye may be seene, is proued by Authority and Experience. First the authority of *Aristotle* in the second Chapter of his booke *de Sensu & Sensili* and in the fourth of his *Meteors* seemeth thus to perswade vs; for (saith he) when the eie is rowled or moued in the dark somthing may be seen within the eie. This Authority is also backed and confirmed by Experience; for in visions or phantismes which doe vsually goe before Suffusions, there do appeare certaine figures, magnitudes, positions and diuers colours, all which are resident in the eie and not in the ayre, for then they would bee equally perceiued of all men, and when a criticall euacuation of blood by the nose is ready to follow, there are seene afore the eies certain red shadowes which they call *marmaryge*. But that these things may appeare more plaine and euident, it will bee behoofefull to note a few things concerning the Nature of Visions or Imaginations.

Authority. Experience.

Of visions or Images.

Concerning such visions, some are (according to *Galen* in his 4. booke *de locis affectis*) of idle headed men, by reason of the wandring and vncertaine motion of the images, and so franticke men doe hunt after flies, catch at a flocke or feather, pickle at strawes and are terrified, yea start and fly from vaine and false images. These visions are not diseases of the eye, but they are symptomes of the brayne and of the imagination.

2. kinds of visions.

Visions by the fault of the braine.

There are also other Visions and representations which are proper to the eyes and the externall Sensitiue faculty; when false imaginations doe obtrude and offer themselues to the eye. For as *Auicen* writeth, there may appeare some small bodies in the ayre and diuers mingled colours which indeede are nothing. This Vision is tearmed by the Arabians Imagination. But *Galen* defines it to be an external apparition hapning by reason of a darke or cloudy vapor which is betwixt the Christaline and the horny coat. It is a symptome or signe of a depraued sight, because certaine outward coloured things doe appeare which indeede are not, the eye iudging that to bee without which indeede is within it.

Visions proper to the eies

What vision is.

The cause of this Symptome is acknowledged of all to bee that shaddowe or cloudy and darke vapour which doth interpose it selfe betweene the horny coate and the chrystaline humour: I called it darke or shaddowy, that is, imperuious, as the Barbarians say, they meane not bright or transluecent. For if that body which is betweene the horny coat and the chrystaline were translucent, these visions would not runne before the Sight, but the *species* of visible things that are pure and not mixed, would haue been carried to the chrystaline.

The cause of such apparitions.

The place of this small bodie or vapour is the whole space from the horny membrane vnto the chrystaline: for if this vapour had beene contayned betwixt the Chrystaline and the coition or meeting of the Opticke nerues, it would not haue raised any such representation, in regarde that the whole reception of the *species* is made in the christaline alone. But if peraduenture this vapor be mingled with the glassie humor which doth hinder the ariuall of the internall light, it would either diminish and weaken this action of Seeing, or else vtterly extinguish it.

The place of this vapour.

It is manifest therefore, that in the beginnings of suffusions, and in criticall euacuations of blood by the Nose, in the *peripneumonia* or inflammation of the Lungs, in the *vertigo* or giddinesse, in the loathing of meate or vomiting; there are gnats and flies & certaine red shadows called *marmaryge* before the Eyes; all which are not in the externall Ayre, for then they should be seene of all men, but are contained within the Eye. We will therfore thus determine the propounded question. That some thing within the eye may be seene, because the obiect is present, that is to say, an interposed body, a *medium* translucide which is the wateriish humour and the principall Organ of Sight which is the Cristalline humour. Yet we affirme that this vision is not perfect. The reasons which are alledged for the contrary opinion and the authorities of *Aristotle* are to bee vnderstood of perfect vision.

What we hold.

But there is another more obscure question, yet to be resolued, namely, whether that which is within the Eye when it seemeth to bee in the outward Ayre be seene by a proper species of it owne or by a strange species.

Question.

I answer, that it is by a strange species; for the vapour which is contained betwixt the horny membrane and Cristalline, is not *perceined* in the shape and species of a vapour, but

Solution.

vnder

vnder another ſhape conteined in the aire; yet this ſtrange ſpecies, when it is receyued into the eye, it followes the Nature, colour, figure and magnitude of that vapor which is already exiſtent in the eye, ſo if the internall vapor be greeniſh or yellow it repreſents the ſpecies of the externall obiects (as of a wall or booke) yellow and greeniſh. If the vapour be ſmall and diffuſed, there do appeare as it were flying Gnats: if it be ſtretched out in length haires do appeare.

Why that which is within doth apear

Now if that which is in the Eye ſhould be ſeene by a proper ſpecies of it owne, the inner Grapie coate which is diuers coloured would be ſeene. Finally, the laſt knot which remaineth to be vntied is this, why that which is within the eye ſeemeth to bee out of it?

Solution

I anſwere, that the Criſtaline humour being accuſtomed to the viſion of external things doth iudge whatſoeuer is within to be without.

QVEST. XXIIII. *Whether the Organ of Sight be Fiery or Watery.*

Plato ſaith it is fierie.

COncerning the Nature of the Eyes the *Platoniſts* & *Peripatetiks* are at great ſtrife. *Plato in Timæo*, becauſe he is perſwaded that viſion is performed by emiſsion of light from the eyes, doth therefore thinke that the eie is of a fierie Nature. The eies (ſaith he) do participate of that fire which dooth not burn, but by illumination doth cheerfully drawe the day out of the Dungeon of the night. Now Fire according to the Platoniſts is threefold. Firſt, that which doth both ſhine and burne: ſecondly, that which ſhineth but burneth not. Thirdly, that which burneth but doth not ſhine. And this opinion of *Plato Galen* ſeemeth to follow in his 10. Booke *De vſu partium*, and in the ſeuenth *De Placitis Hippo. & Platonis*. For he calleth the eye a bright organ and the Sun-like part of the creature.

The Platoniſts reaſons.

The Reaſons of the Platoniſts be theſe. Firſt, the eyes of ſome creatures do ſhine & glitter in the night, as of Night-Owles and of Cats. Againe, ſome in vehement fittes of anger haue their eyes as it were burning and enflamed. Moreouer, when the eie is ſhot at one ſide, we ſee a kinde of fierie glaunce like Lightning, and the Eye being rubbed in the darke doth yeelde a bright glimpſe vnder the finger. *Ariſtotle* affirmeth, that *Antiphon* had his owne ſhape and Image continually before his eies. And *Pliny* reports many things of *Tiberius Cæſar* in the 11. booke of his Naturall Hiſtorie. *Galen* alſo in the ſeuenth Booke *De Placitis Hippocratis & Platonis* maketh mention how it hapned vnto one many nights before he vtterly loſt his Sight, that he perceiued a great quantity of light to yſſue foorth of his eyes. Furthermore that the eyes be fiery may be thus demonſtrated, becauſe they are verie agile, plyable and mooueable: now facility of motion is from heate. They are alſo tranſlucid of a pyramidall Figure and full of ſpirits, becauſe they performe their functions in a moment. To theſe we adde, that to the moſt noble *ſenſoriũ* or organ is due the nobleſt element, which is the fire. Againe, the ſenſes are of the ſame Nature with the things which are ſubiected to them: but colours are of a fierie Nature, for ſo *Plato* defines colour to be a flame yſſuing from the bodie coloured.

The opinion of *Ariſtotle* that the eie is watery.

Laſtly, the eyes neuer grow ſtiffe as do other parts of the bodie, whence it followeth that they are of a fierie nature. On the contrarie part, *Ariſtotle* and all the Peripatetiks do contend that the eye is waterie, but he that deſires more ſatisfaction heerein may reade thoſe things which the ſame *Ariſtotle* writ againſt the Platoniſts in his Booke *De Senſu & Senſili*.

The authority of *Hippocrates*. *Democritus*. Reaſons.

We will ſubſcribe rather to this latter opinion, and the ſame doth Diuine *Hippocrates* affirme in his Booke *de locis in homine*, *The Sight is nouriſhed by the humiditie of the Braine*. Of the ſame minde alſo was *Democritus* as *Ariſtotle* reports in his Booke of Senſe. Laſtle, Anatomie and the whole compoſition of the eies doth conuince this. For the principall parte of the eye which firſt of all cauſeth viſion is all ycy , which part being drowned in the glaſſy humor, hath in the forepart a watery humor ſo diſpoſed for a defence. And if the eye be hurt or wounded, whatſoeuer doth flowe from it is watery.

Carpentarius reconciling *Ariſtotle* & *Plato* is reproued.

Some haue laboured to reconcile *Plato* with *Ariſtotle* after this manner: There be two things to be conſidered in the eyes which concurre to this act of viſion: firſt a moſt clear Viſiue ſpirit flowing from the Braine through the Optick Nerues, and ſecondlie the Criſtalline humor. Now according to this diſtinction they ſay, that in regard of the ſpirits & the internall light, as alſo of the enlightned obiect the eye is fierie, but in regarde of the Criſtalline it is watery. But this diſtinction ſeemeth not to be altogether tollerable, for ſo euery organ ſhould be fiery, becauſe the organes of all Senſes haue their animall ſpirites

of

of the same Nature, tenuity and brightnesse. For there are not diuers kindes of the Animall spirits; that some should be appointed to the sight, others to Hearing: I therefore hold it better to affirme simply according to *Aristotle* and indeed the truth it selfe; that the Organ of sight is watery.

Concerning those reasons which are produced in defence of the *platonistes*, they be of small moment; for the eyes doe shine indeede, and oftentimes a bright splendour doth proceed from them, but not by reason of the fire, but because of the tralucencie, playnnes and smoothnes of the chrystaline and the coates; for whatsoeuer things are smooth and neate do shine in the dark, as horne. Againe, it hapneth because the externall light receiued of the chrystaline doth not presently vanish. They are mouable & for this cause called by the Poet *faciles*, yet this is not from the fire but from an aboundant and slipry humidity, from the spirits and the sixe strong muscles, by which it is an easie matter for a small member to be moued.

The reasons of the Platonists answered

Why the eye doth shine.

They are called spirituall by reason of their action, for they perfourme their function in an instant, and because they receiue incorporeall and immateriall *species* or formes produced & brought thorough the ayre and continually offering themselues to the *Pupilla* or Apple. They are not stiffe, yet this is not because they are firy, but as *Aristotle* teacheth in his Problemes, because they are inuironed with aboundance of fat; which fat though it haue for his efficient cause a defect or weakenesse of heate; yet notwithstanding by his reflexion it doth augment the heate, and by his slimenesse doth hinder the ingresse of the ayre which beateth vpon them. To these wee ioyne the plenty of animall spirits, and the perpetuall motions of the eyes.

Why they are called spirituall.

Why not stiffe

QVEST. XXV. *Wherefore the Eyes be diuersly coloured.*

ARistotle in the second book *de Anima* saith, διαφανὲς ὄμμα ἀποιον εἶναι. *Euery Organ must be deuoyde of any quality*, least all things should sauour of that same quality which is in the Organ: but the Eyes are the Organs of Sight, they therefore ought not to bee coloured, for if they were, all things would appeare to bee of the same colour; for all things appeare red to those that labour of an inflamation of the Eye, or haue the blood collected in them by a blowe, or stripe, or otherwise.

In like manner, those that are troubled with the Iaundise, because their Eyes are coloured with yellow choller, doe see all things as if they were yellow. On the other side, that the Eyes are coloured, euen our owne Sense doth teach vs; for some men are Wall-eyed, some mens eyes blacke, some mens skie-coloured and others greenish, and so in the rest. We answere according to *Aristotle*, that the name of Colour is sometimes vsed more largely, sometimes more strictly. In this large signification all things which may be seene are sayed to be coloured. So transluscent things though that cannot limit or determine the sight yet are they coloured. *Aristotle* in his booke of colours cals the ayre white and the fire red. But there is another acception of colours more strict whereby it is defined thus. A colour is the extremity of a terminated pellucide body.

A double acceptation of colours.

In the first signification the whole eye is coloured, all his partes are coloured, because they are aspectible and may bee seene, but in the latter signification onely the coniunctiue and grapy coat are truly coloured, for the *Adnata* is white, the grapy is diuersly coloured, blacke, blew and grasse-greene, to recollect the spirites that were before disipated or dispersed, that it might breake the splendor of the external light, and that the chrystaline humor might be as it were refreshed with that colour as with a Looking-glasse. But the principall part of Vision which receiueth the *species* of visible thinges and is changed by the colours is not at all coloured but bright and lucide only. Now light and perspicuity or natures common to all visible *species* which helpe the reception of these *species*. *Aristotle* hath obserued in lib. 5. chap. 1. *de generat. Animal.* which also *Pliny* repeateth in lib. 2. cap. 37. of his Natural histories, that onely the eyes of a man are of manifold & diuers colours: in other creatures the eies are all alike according to their kind: so the eies of all Oxen are blacke, the eyes of Sheepe watery, of other creatures redde, excepting a Horses which are sometime wall eyed, but the eye of a man is diuersly coloured.

How the eie may be said to be coloured.

Of the colours of the eye some be extreame some of a middle nature. The extreame colours are according to *Aristotle*, *Galen*, and *Auicen* two, namely the whitish or wall coloure and the black. This wall-colour is somewhat whitish, and *Aristotle* in his 5. book *de gener. Animal.* and *Galen cap. 27. Artis paruæ* seeme to oppose this wall-colour to blacke.

The differences of the colours of the eye.

This *Cæsius* or wall-coloured the Grecians call γλαυκὸν from a Night-Owle which is called γλαὺξ, whose eyes shine with a greenish whiteneſſe. Some do confound γλαυκὸν καὶ χαροπὸν, and yet they are to be distinguished, for though either colour do somewhat tend to greene, yet this γλαυκὸς or wall-coured doth approach neerer to white, & χαροπὸς or tawny vnto Red. *Aristotle* in his Phisiognomy of the eyes affirmeth this wall-colour in the eie to be a signe of a fearfull man but this Tawny colour of a bold and stout courage; therefore the Eyes of Lyons and Eagles are properly said to be χαροπὸι or Tawny, but the eyes of old men and children to be wall coloured. Either colour doth shine, but that brightneſſe which is in wall eyes is more white like that which is in the scales of Fishes, in tawny eies the splendor is fierie as it is in burning coales. The intermediate or mixt colours of the eies are diuers, according to the diuers mixture of the extreames.

The cause of the variety of colours. *Empedocles.*

Concerning the causes of this varietie of colors there are diuers opinions according to the diuersity of men. *Empedocles* composed the eie of Fire and water, wherefore hee supposed that the wall-colour proceeded from the predominance of the fire, & the blacke from the aboundance of water.

Aristotle.

Aristotle in his fift Booke *De generatione animalium* referres the cause of these Colours vnto the plentie or scarsity of humors which he doth illustrate by this example of Aire and water. For (saith he) if we looke into a deepe water or into thick aire, they wil both seeme blacke and obscure; but if either of them be rare and thin the colour will appeare Tawnie and splendent. The blackneſſe therefore of the eye is from the plentie and aboundance of humors, the wall eie is from the paucitie and scarseneſſe.

Auerrhoes.

Auerrhoes thinkes that the whiteneſſe of the eye proceedes from coldneſſe, becauſe for the most part all white things are cold, as the Braine, the Fat, the Marrow, the Bones, the Membranes; and blackneſſe from heate.

Galens opiniõ

Galen in the 27 chapter *Artis paruæ* referres the cause of colours vnto the plenty, splendor and situation of the Cristalline and watry humors. For (saith he) a wall eie commeth by reason of the plenty or splendor of the Cristalline, or becauſe of the prominent & bunching situation, and also the paucity and purity of the thin and waterie humor. But a blacke eye comes either from the scarsitie of the Cristalline, or from the ouer-deepe situation of it, or becauſe it is not exquisitely splendid and cleare, or becauſe the waterie humor is too aboundant, and yet not altogether pure. Thus farre *Galen*.

Auicens opinion.

Auicen referres the cause of the variety of these colours vnto the Grapie coate, which as it is diuersly coloured it selfe so it doth produce diuers colours in the eie, a black coat causeth blacke colour, as a blewish coate a colour of the same kinde, and his opinion dooth *Vesalius* follow.

But to the end that we may reconcile the different opinions of so graue Authours wee do acknowledge three causes of this variety, the Humors, the Coats and the Spirits. The Humors of the Eye are three: first the watery, secondly the Cristalline, thirdly the Glassy. This last becauſe it cannot be perceiued and is placed in the hindmost part of the eie doth conferre nothing or verie little vnto the diuersitie of colours: but this vertue of alteration and changing the colour of the eye dependeth most vppon the watery and Glasy or Cristal humor. In these humors also three things are to be considred, their Substance, Quantity & Situation. By the name of Substance I vnderstand the purity or impurity, the splendor, darkneſſe, teuuity and density. The Quantity doth note the plentie or scarsity of the humour. The Site is either more hollow and profound or more prominent and bearing out.

The first cause referred to the humours.

In humors 3 things to bee obserued.

There be therefore three causes in respect of the Cristalline, of a wally and white colour in the eie. First, the plenty of the Cristalline, secondly the purity and splendor thereof and his prominent Situation, for so the Cristalline humor by his own & proper brightneſſe illuminateth the watery humor and the whole eie. By reason of the waterie humour there bee two causes of this wallineſſe, the splendor and the paucity or scarsity of it, for a small and pure watery humor doth leſſe hinder the fulgor or brightneſſe of the cristalline Humour.

The cause of blackneſſe.

The causes of blackneſſe are quite contrary, as in the behalfe of the Cristaline the paucitie or smalneſſe of it, his impurity and deep situation; and in respect of the watery the impurity and plenty is the cause thereof. But haply that which *Aristotle* writeth in the 14 Probleme and the 14. Section may seeme to contradict our assertion, where hee saith the Ethyopians haue blacke eies, and those that inhabit the North white, but in the Ethyopi-

Obiection.

ans

ans there is leſſe plenty of the watery humour, by reaſon of that ambient Ayre exicating or drying vp all things, in thoſe of the North it is more aboundant.

I anſwer, that the Eyes of the Ethiopians be blacke, by reaſon of the paucity of their Viſiue ſpirits (for they are reſolued and diſſipated by the heate) whereby it happens that the light of the ſpirits failing, the Eye appeares as it were darke or ouerſhadowed. But the Northerne people doe abound with many ſpirits. The intermediate colours doe depend vpon intermediate cauſes. Solution.

The ſecond cauſe of the diuerſitie of colours in the Eye may be referred to the Coate called *ἀμφιβληστροειδὴς*, that is, *vueam* or the *Grapy coate*, for this onely becauſe it is diuerſly coloured, cauſeth a variegated or diuers coloured Eye. So in the circle of the Eye which they call the *Iris* or Rainebow, diuers colours doe appeare becauſe in that part the *Grapy* coate is diuers coloured. The ſecond cauſe of the diuerſitie of colours.

Laſtly, we thinke that the Viſiue ſpirits doe alſo conferre ſomething to the varietie of theſe colours, for thin, pure, cleare and copious ſpirits cauſe whiteneſſe, but craſſe, impure, foggy, and few are the cauſe of blackenes. The 3. cauſe. Now that there be ſpirits in the Eye may be manifeſt by theſe arguments. Firſt, becauſe while the creature is aliue, the Eye ſeems to be exceedingly ſtretched, neither is any part thereof looſe and corrugated, and the one of the being ſhut the *pupilla* or Aple of the other is preſently dilated, to wit, becauſe the ſpirits paſſe more plentifully through the Netlike coat into the Grapy. Laſtly, becauſe ſometimes the Eyes appeare languide and obſcure, ſometime chearefull and ſplendide or bright.

QVEST. XXVI. *Of the Muſcles of the Eyes and their motion.*

SEeing the Eyes be as ſcourwatches, night and day watching for our good it is of neceſſity that they ought readily to bee mooued euery way, that with facility they might be conuerted whither ſoeuer we would; and to this motion a Nerue of the ſecond coniugation and ſix Muſcles do ſerue. The firſt whereof liſts vp, the ſecond doth depreſſe, the 3. doeth draw forward, the fourth draweth backeward, and two doe leade the Eye about. By all theſe performing their functions together, and ſtretching their Fibers, is the Eye ſtayed and fixed. For it is not (as *Galen* would haue it, and almoſt all Anatomiſts following his ſteps) eſtabliſhed or fixed by a ſeuenth Muſcle compaſſing the Opticke Nerue, becauſe this Muſcle is onely found in foure-footed beaſts which looke prone toward the earth leſt their Eyes ſhould fall out of their Orbes: which Muſcle in a man is neuer to be found. This motion whereby the Eye is thus firmed, the Phyſitians call it *Tonicum* or a ſet Motion, and it is twofold, the one *κατὰ φύσιν* or *according to Nature* when the Fibres of all the Muſcles are equally intended or ſtretched, ſo that the Muſcles ſeeme then to be at reſt; the other *παρὰ φύσιν*, *beſide Nature*, when the Eyes remain fixt & immouable whether we wil or no. Which poſition *Hippocrates* in his booke *de victus ratione in morbis acutis* cals *πῆξιν, ἀκινησίαν* and *στάσιν* that is, a Congelation and Immobility, or Setting and fixing of the Eye. This fixednes or immobility hapneth when the facultie of the Muſcles which moue the Eye is reſolued, weakned or wholly extinguiſhed; or becauſe theſe muſcles are al equally gathered or contracted into their heads. This poſture of the Eye they call *στάσιν ἰσόῤῥοπον*, that is, a ballanced or equall fixing of the Eye, which affect or diſeaſe is contrary to that they call *ἵππος*, where in the eyes haue a wandring & vnconſtant ſtaring, as a horſe looks that is full fed; whence alſo the diſeaſe tooke his name.

There are therfore only ſixe Muſcles of the eie not ſeuen, and of theſe, foure haue the gouernmēt of the right motions, two do obliquely lead the eye about. And thus may certain differing places in *Galen* be reconciled, for in his tenth booke *de vſu partium*, hee ſaith, that there are onely foure motions of the Eyes; but in the fourth *de locis affectis*, he determines that there be ſixe.

Concerning the originall of theſe Muſcles, Anatomiſts are not al of one minde. Some of them ſuppoſe that they ſpring from the hard *meninx* within the ſcull, but wee are of opinion that the foure right Muſcles together with that oblique whoſe Tendons is compaſſed about with the pully, doe ariſe from that inſide of the Orbe which is made by a portiō of the wedge bone; & this we are taught, ſaith my Author, both by experience & by Autopſie or ocular inſpection. But from the membrane they neither ought nor can haue their originall. They ought not becauſe a membrane of an exquiſite ſenſe doth com-

compaſſe the Optick nerue; and therefore the muſcles in their motions would compreſſe this nerue, and ſo offer violence to the Sight; they could not, becauſe they ſhould not haue adhæred to a firme *baſis* or foundation.

QVEST. XXVII. *Two obſcure and intricate queſtions concerning the motion of the Eyes are reſolued.*

First queſtion

WE will now proceede to diſcuſſe a very hard probleme concerning the motion of the Eyes; the enodation of which knots (for ought I know) hath not as yet beene performed of any man. And it is this: wherefore the eyes conſidering they haue ſeuerall diſtinct muſcles by themſelues, are yet not moued with diuers motions, but are guided together and at the ſame time with one and the ſame motion. Neither can it be that the right eye ſhould be moued and the left ſtand ſtill; neither can the right be lift vp and the left depreſſed, which identitie of motion is not to bee found in any other part of the body. For I haue free liberty at the ſame moment to mooue my right hand vpward and my left downward.

Why the Eies are moued together with the ſame motion.

The Solution of *Ariſtotle*.

Ariſtotle propounds this queſtion in his Problemes, which thus hee endeauoureth to reſolue. Though, ſaith he, the eyes be double, yet there is but one beginning of their motion and the ſame originall, to wit, in the Coition or meeting of the Optick nerues. Hee therefore referres the cauſe vnto that Coition.

Auicen the Prince of the Arabians ſeemeth to bee of the ſame minde and *Galen* in his bookes of the vſe of parts, where he thinketh the Opticks doe therefore meete in one, that one Obiect ſhould not appeare double. Theſe things haue ſome ſhew of probability, but they doe not giue vs full ſatisfaction: For the meeting of the Opticks doth conferre nothing to the motion of the eyes: the Opticke nerue doth onely ſee and carie the viſiue ſpirits vnto the Chriſtialine, neither is it inſerted into the muſcles of the eye.

Ariſt. anſwere diſallowed our reaſons.

It is onely the ſecond coniugation which mooues the eies; in that oppilation or ſtopping of the opticke nerue and in the diſeaſe which the Arabians call *Gutta ſerena* the action of Sight doeth wholly periſh and yet the motion of the eies is not a whit hindred; the meeting therefore of the optick nerues doth nothing further the motion of the eyes. Some haue obſerued that in many men who all their life long neuer complayned of their Sight, the Opticke nerues were ſo framed, that they were continually ſeperated and did neuer meete together. It is therefore very fond and abſurd to thinke that both the eyes are moued with the ſame motion, becauſe there is one onely beginning of motion in the meeting of the Opticks; ſeeing neither that Coition nor yet the Opticks themſelues doe any whit further the motion, but onely the Senſe of the Eyes.

The true reſolution of the queſtion.

We doe acknowledge a double cauſe of this motion, the Finall and Inſtrumentall. The Finall cauſe is the perfection of the Senſe. And this is the perfection of the Senſe, that the Obiect appeare euen ſuch as it is; but if the Eyes were moued with diuers motions, that one might be caried downeward the other vpward, ſurely euery Obiect though in it owne nature one and the ſame, yet would continually appeare double; and ſo the moſt noble Senſe would be deceiued and the action of Sight would bee imperfect. If this ſeeme harſh to be beleeued you may thus make triall of it. If you either lift vp the one eye, or depreſſe it with your finger you ſhall ſee all Obiects double, and diſcerne the one to be higher and the other lower, becauſe the one eye is moued vpward the other downward. But if you ſhut either of them, this double apparition of the Obiect will vaniſh, although you preſſe that eye with your finger: Alſo if you mooue your eye to the right hand or to the left, the Obiect will not appeare double, becauſe the Aples of the eyes remaine both in one line.

Queſtion.

Solution.

But wherefore vpon the diuers motion of the eyes the Obiects are doubled, is a thing worthy to be vnderſtoode. *Galen* in the thirteenth Chapter of his 10. booke *de vſu partium* writeth, that the Diameters of viſible Cones or turbinated formes muſt be placed in one and the ſame plaine; leaſt that which is but one ſhould appeare double. But if one of the eyes be moued downward, the Aples of them both will not be in the ſame plaine and the ſame ſuperficies; and ſo the Obiect would appeare double. For then becauſe the beame of the one eye doth not equally reach the Obiect, as neither doth the beame of the other, that which the Senſe *perceiueth* twiſe, it perceiueth as if it were double or two ſeuerall things; which alſo happeneth in the Senſe of Touching, for if one finger be ſo folded with the other, that it be layed aboue it, and therewith a man touch a ſtone, the

Touch

Touch will iudge that to bee double which is but one. In the Palsie or the conuulsion of the muscles of the eye, it hapneth that the Obiects present themselues in a double forme, because the eyes depart from the same superficies: so also the Opticks being either loosened or conuelled, the pupilla or Aple doth not reteine his equality, whence it commeth to passe that all things appeare double, and so sometimes a drunken man will thinke all thinges that he seeth double. In like manner, some that are *Strabones*, that is Squint-eyed, doe see things double, because one of the Pupillaes is either raised vp or depressed. But if the eyes be in the same plaine, though they be two, yet the visible thing is presented simple before them, because the same Species and the same magnitude at the same time is receiued of both the eyes; and are together offered to the Common Sense, which doth not discerne any thing but that which is present.

We conclude therefore, that first in respect of the finall cause, (which as wee haue often repeated out of *Aristotle*, is the first and chiefe cause in the works of Nature) it is that the two eyes bee together and at once mooued. I say, this is because it doth much tend to the perfection of the Sense. And Nature doth continually fit her Instruments as they may best further the finall cause, which whither you call the vse or the necessity it is no great matter. And therefore she hath so disposed the nerues of the second coniugation which doe carie the commaund of motion and the animall spirit into the muscles, which are therefore termed *Porters* and *Cadgers*, that in their beginning they are continuall, making as it were on chord, whence it is that the right cannot be moued but the other will follow his motion. And this is a new and a most elegant obseruation. The conclusion.

The other question we shall discouer out of *Cassius*, to wit, wherefore the disease of one eye doth more vexe vs then if both were diseased? Whether it is because when the one eye is sound and according to Nature and therefore is diuersly moued, the sore eye is also mooued therewith? Hence it is that the mutuall and equall motion doth exasperate the payned eye. For when a member is affected it would haue rest. But if both the eyes be effected together, the paine becomes more tollerable, for they both rest together, and from that rest they sooner attaine vnto their former naturall disposition. The second question why the disease of the one eye onely dorh more prouoke vs. Solution.

QVEST. XXVIII. *Of the Humours of the Eyes, whether they be animated parts.*

THe Humours of the Eye are three, the Cristalline, the VVaterie, and the Glassie. Of these the Cristalline is the principall Organ of Sight, as *Galen* teacheth in the 2. booke of his Methode, in his 8. booke *de Instrum. Odoratus*, the 8. and 10. *de vsu partium*, and the first *de Symptom. causis.* And these arguments amongst the rest doe euince it. That this Humour is the most cleare and shining of all the rest; that it is seated in the middle of the Eye; that it alone receiueth the Species and Images of things; that it onely is altered by colours; and that in it is made the concourse and meeting both of the Externall & Internall light. And therefore when the beating of both the lights vpon the Cristalline is hindered by suffusions and obstruction of the Opticks, the Action of Seeing doth quite perish as if a Candle should be extinguished or put out. The Cristalline is the principall Organ of Sight.

Now concerning this Cristalline humour, there may three questions be demaunded. First, whether it be a part. Secondly, whether it bee a Similar or Organicall part. Lastly, whether it performe the Action of Seeing by his temperature or by his conformation.

That it is an animated and liuing part of the body may be confirmed by authority and also by reasons. For authority we haue *Galen* in the 6. Chapter of the first booke of his Methode, and also in the first booke *de Sympt. causis*, accounting the Christalline among the parts. Reason also perswadeth vs no lesse: for it doth primarily & principally performe the Action of Seeing; and Actions are not but of parts only. Againe, it is nourished and liueth and is generated in the wombe together with the other partes. It hath moreouer his proper circumscription: and lastly, it is a body adhæring to the whole, and ioyned in the Societie of a common life, framed also and made for the vse & office of the whole. That the Cristalline is a part. Authority.

But whether it bee a Similar or Organicall part, it is greatly controuerted. Some doe contend that it is not a Similart part, because, say they, it is neither bone, nor gristle, nor ligament, nor membrane, nor yet any of those tenne which *Galen* describeth in his booke *de Inæquali intemp. de Elementis & de Temp.* Whether it be a Similar part.

Contrariwise it is prooued to bee a Similar part in the sixth chapter of the 1. booke of his Methode, for those, sayth he, are called Similar parts which may be cut and diuided into parts like themselues, as the Cristalline and the glassy humours in the eye. And in another place he sayth. That in euery perfect Organ that is a Similar part which is the beginning and cause of the action; as in the eye is the crystalline; and that it is an Organicall part the situation thereof in the middle of the other humour, his figure like a Lentile or Fitch, and the magnitude of it doe demonstrate which three are of the essence of an Organ.

I answer, that a Similar & Organicall part are not opposed one to another. It is no matter therefore whether you call this Cristalline a Similar or an Organicall part. For it is Similar, both by reason of his substance and temperament, because it is wholly watry, pellucide or bright and like it selfe in all parts. It is also Organicall by reason of the figure, whereupon *Galen* in first booke *de Symptomatum causis*, determines that some of the affects of the Cristalline be Similar, as his dry distemper which maketh the disease called *Glaucoma*, & the moyst which makes that affect which they call πυκλωσιν: other affects are Organicall, as when it is mooued from the naturall situation, vpward downeward, to the sides, inward & outward; add hereto the greatnesse, littlenesse, and the solution of continuitie. And whereas *Galen* doth make mention only of ten Similar parts he meaneth onely Common parts, which are found almost through the whole body: for the marrow of the braine and of the backe, and the humours of the Eye are parts, and yet may not bee referred to any of those Ten.

Whether the Cristalline performe his functiō by his conformation or by his proper temper.

But it is a poynt of deeper contemplation and requires more diligent inquisition to know whether the Cristalline performe this act of sensation as it is a Similar part, or as it is Organicall, that is, whether by vertue of his temper or by the meanes of his figure; yet *Galen* in the sixth chapter of his first booke of Method seemeth to referre it to the temper; for, saith he, the Cristalline is the principall Organ of Sight, because it is altered by colours, and this alteration is from the purity and brightnes of it; now the purity and brightnesse come from the temperament. Indeede the magnitude, vnity, lentil-like figure of it, and his situation in the middest of the humours are not without vse, but they affoord the same helpe vnto vision that the other humours and the Membranes doe, that is, they make it more perfect: It is therefore manifest enough by this that hath beene sayde, that the Cristalline humour is a part.

Whether the glassy humor be a part.

But the question is more ambiguous concerning the glassie and watery humours. All the Antients thought that the glassie was the nourishment of the Cristalline, and the watery the excrement of it. *Galen* in the 10. book *de vsu partium*, writeth that the glassy humour turneth into the Aliment of the Cristalline; for saith hee, it could not bee that the Cristalline humour which is white, cleare and splendent should be nourished by pure & meere blood, because it doth much differ there from in qualities; it therefore required an Aliment more familiar and nearer to it owne nature, and this proximity and familiarity is in the glassy humour which is composed by Nature fit to make the Aliment of the Cristalline. For this glassy humour by how much it is thicker then blood and more white, by so much doth the Cristalline exceede it in humidity and whiteneſſe. But if the Cristalline be nourished with the glassy humour, then cannot the glassy be an animated part, because no part doth nourish another.

That it is a true part.

Yet *Galen* in the sixth chapter of the first booke of his Methode, nameth the glassie humour in the Catalogue of the Similar part, and in the first chapter of his tenth booke *de vsu partium*, he thinkes that it is nourished by διαπόσιν or Transumption by the coate which compasseth it about. If then it be nourished it is a part.

We suppose the glassy humour to bee no lesse an animated part of the eye then the Cristalline, for it hath a proper circumscription, it is generated in the wombe of the purest part of the seed, it is augmented as the other parts of the body, it is nourished with blood, it receiueth veyns from the *hairie crowne*, it is couered with a proper coate, and being once effused or spent it will neuer be recouered.

How the glassie humour doth nourish the cristalline.

They which say that the Cristalline is nourished with the glassy humour doe speake improperly: indeede it prepareth the blood for the Cristalline by changing it, least the pure Cristalline should be infected with a red colour and with veynes; for it behooued that the Cristalline should be deuoyde of all colours; yet the substance of the glassy humour doth not transforme it selfe into the cristalline, nor is assimilated into it. And (saith *Galen* in his booke of the eyes) the glassy humour is affected to the cristalline as the stomach is vnto

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the Liuer;but the Stomacke doeth prepare and minister meate to the Liuer as a Cooke, and so doth the glasy humour to the chrystaline.

Auicen thinks that the vvatery humour is an excrement of the chrystalline, and therefore denies it to bee a part. Adde moreouer,that it is fluide like bloud and hath no proper circumscription. But vvee call it a part because it continually keepeth the same proprieties of figure,purity and quantity; because it performeth some vse vnto the chrystalline, and is as it were a defence vnto it, and like a spectacle to carry the images vnto the chrystaline: wherefore *Aristotle* cals it the *Porter* or *Cadger of Images*. This humour also if it should flow out cannot be recouered,& such effluxion doth wholy extinguish the sight. But all these properties doe not agree with an excrement. Moreouer it is heereby demonstrated that it is not an excrement of the chrystaline, because the coate called *Arachnoides* or the Cobweb doth intercede or come betweene these two humours.

Auicens opinion.

Auicen refuted.

If they obiect and say that it flowes vp and downe like blood and doth not adhere to the whole. I answvere that it flovveth vvhen it is out of the eye,but not at all vvithin the eye,neither doth it change his place but is continually contayned in a certayne and proper seate.

QVEST. XXIX. *Of the originall of the Opticks,their meeting and insertion.*

SOme thinke that this Opticke nerue is not a whit inferiour to the Chrystalline humour in dignity,vse and necessity. For *Auicen* is of opinion that the *species* and images of visible thinges are hereinto receiued. Wee haue already taught (with *Galen*) that the chrystaline humour is the principall organ of Sight, and that the Opticke nerue is the conuayer of the visiue faculty and the internall light, to wit, of the visiue spirit.

But that the history of the Opticks may be made more manifest,there are foure things to be inquired into.

First,what is their originall. Secondly,what is their insertion. Thirdly,how they meete or are conioyned. And fourthly,whether they be hollow.

Concerning their originall and beginning there bee diuers opinions. *Auicen* thinkes they arise out of the forwarde ventricles of the braine; others out of the Center of the brayne,and some out of the After-braine. We haue obserued,sayth *Laurentius*,that out of the lower and hinder part of the brayn neare vnto the spinall marrow,yea out of a part of the spinall marrow it selfe within the Scull two of the most large and soft nerues of all the braine doe arise.

Diuers opinions of the originall of the opticks.

They could not arise from the forward ventricles of the braine, becuse there weere the Mammillary processes, nor from the middle Basis of the brayne, because this place was appoynted for the purging thereof; nor yet from the After-braine because the Sight requireth a very soft nerue, but the After-braine is very hard and not white. The Optickes therefore must arise from the lower and hinder part of the brayne; out of each side one,which being obliquely streatched out and separated,do meete in one almost in the middest of their progresse.

The true opinion.

Concerning this their meeting two questions are to be resolued,to witte, howe they meet,and secondly why they meet.

Of the meeting of the opticks.

The manner of their meeting hath not beene knowne till of late dayes. For almost all the ancient Physitians hold,that in their contaction they thwart one another like a crosse, (which thwarting or intersection is called χιασμὸς) and so the right nerue is carried to the left eye,and the left to the right eye. Others doe not thinke that they thus crosse and intersect one another but onely obliquely touch themselues.

But we,saith *Laurentius*, something more accuratly and diligently contemplating the manner of this coition or meeting of the Opticks,do thinke that the marrow is mingled and confused in the middle of either nerue. For if they were only contiguous touching one another and not mixed and confused the *Pupilla* or Apple of the one eye woulde not so in a moment be dilated when the other is shut. The Opticks therefore doe meet and are so mixed in the middle of their passage or iourney, that the one cannot by any Art be seuered from the other: this is the manner of the coition of the Opticke nerues.

The manner of their coition.

Now it behoueth that we looke vnto the finall cause,namely, wherefore the Opticks doe meete. First it was necessary that they should meete for strength, to wit,that by this con-

coniunction or embracing one of another they might not ſuffer any violéce in the whole length or tract of their iourney. For being of all the nerues the moſt ſoft, and creeping ſo long a iourney they would haue been looſe and flaccid, nor carried in a right line into the *Pupilla* or Apple, vnleſſe they had beene vnited in the middle of their paſſage.

So Nature is wont to ſtrengthen thoſe things which are more ſoft and weake as it were vvith knottes in the middeſt, as may appeare in the right muſcles of the *Abdomen* or Paunch.

2. Reaſon. Secondly, it behoued that they ſhould meete that they might keepe the ſame plaine and *ſuperficies* in the Apple: for vnleſſe they had thus met they vvould haue departed from one and the ſame plaine. So the eyes being deceiued would haue iudged a ſimple obiect to be double: for it behooued (as we haue declared euen now out of *Galen* in the 13 chapter of his tenth booke *de vſu partium*) that the Axes of the Viſiue Cones ſhould be placed in one and the ſame plaine, leaſt the obiect which is ſimple and ſingle ſhoulde appeare double.

The third. *Galen* in the 14. chapter of his tenth book *de vſu part.* acknowledgeth a third cauſe of this their meeting, (to wit) that the formes & Images of viſible things may be vnited. For though the ſpecies be carried through two organs, yet they appeare ſingle and not double. And this was *Ariſtotles* minde in the firſt booke of his Problemes and the third Section, where he demandeth why the eyes are together and at once mooued? becauſe (ſaith he) they haue one beginning of motion (to wit) the meeting of the Opticke Nerues. And *Auicen* is of the ſame opinion.

But I (ſayth *Laurentius*) doe not altogether approoue of this cauſe of theyr coition. For *Veſalius* writeth, that he obſerued in a young man that theſe Opticke Nerues did no where meete, and yet he neuer in the whole courſe of his life complained of any depraua-tion or infirmity of Sight. *Ariſtotle* writeth in his ſecond Booke *De anima* and in the 4. of his Metaphyſicks, that the Senſe is neuer deceyued about his proper obiects. What need is there then of this coniunction? Againe, if wee obtained this by the coition of theſe Nerues, that the ſpecies and formes of either eie be vnited into one, then why ſhould not thoſe many things which are ſeene together appeare but one?

In like manner, though there be two eares and two noſethrils, yet the obiect doth not appeare manifold to the ſenſe. It is not therefore from this coition of the Opticks that the obiect appeareth ſimple, but becauſe the Apples of the eyes are in the ſame plain, and are turned toward the viſible obiect at the ſame moment. Fourthly, ſome would haue the

The 4. reaſon Opticks to meete, to the end they might more fitly proceed out of the perforation in the Scull, and ſo might be carried directly to the eies.

The 5. reaſon Laſtly, *Galen* in the 14. chapter of his tenth booke *de vſu partium* conceiueth that they meete, that ſo the viſiue ſpirit might paſſe from the one eye into the other in a moment for the perfection of the Sight, ſo the one eye being ſhut wee doe ſee more accurately with the other. And theſe are all the cauſes of this coition or meeting of the Opticke Nerues.

The inſertion of the opticke Nerues. Let vs now follow on and declare the manner of their inſertion. The Opticke Nerue dooth conſiſt of a double ſubſtance, an internall which is Marrowye, and an externall which is membranous. The inner Marrow when it attaineth to the Criſtalline humour is dilated and ſo diffuſeth Viſiue ſpirits through the whole eye. Out of this dilatation ariſeth a coate which they cal ἀμφιβληστροειδῆ or the Net-like coate, which (as *Galen* teacheth in the ſecond chapter of his tenth Booke *de vſu partium*) doth neither in colour nor ſubſtaunce deſerue the name of a Coate, but if you caſt it into water you ſhal ſee it reſemble the ſoft, white and marrowy ſubſtance of the Braine.

But the outward part of the Opticke Nerue doth conſiſt of two coates, the one whereof is propagated from the thin *Meninx* the other from the hard, the one is ſpent into the grapie coate the other into the horny membrane; whence it is, that by the continuitie of this Opticke nerue the Animall ſpirit is carried euen in a moment vnto the Apple of the eye.

Of the cauitie of the opticke Nerue. Concerning the laſt queſtion which is of the inner cauity of the Opticke nerue, *Galen* writeth in the tenth Booke *de vſu partium* that they are manifeſtly hollow, and therefore *Herophilus* called theſe nerues πόρους, becauſe they are perforated or holed through. But we do not admit this ſenſible cauity in Nerues, yet we would haue them to be the moſt ſofte of all the Nerues, and more ſpongie that they might receiue and tranſport a more copi-ous and abundant ſourſe of Animall ſpirirs.

QVEST.

QVEST. XXX. *Whether the light be the obiect of the Sight.*

THere be ſome which do determine that light is the obiect of Sight, grounding their opinion vpon this foundation, becauſe euerie thing which is ſeen either is light, or it is ſeene by the light, or as *Simplicius* ſaith, that vvhich is ſeene *is either light or nere a Kin vnto it*, concluding hence, that light is viſible by it ſelfe, but colours and other things onely by the meanes of light, inſomuch as light is the cauſe wherefore they are ſeene. But none of theſe are true, & firſt of all that propoſition may not be granted, to wit, that whatſoeuer is ſeene is either light or is ſeene by the light, or is very like to it. For if they take Seeing in ſo large a ſenſe *as to perceiue a thing with the Eyes* (as it is neceſſary that they muſt grant, for elſe we will denie that the light it ſelfe may be ſeene) then would alſo darkneſſe it ſelfe be ſeene, which neyther is nor may be ſeene by the light, neyther is it of a nature like vnto it.

Their reaſons which ſay light is the Obiect of Sight.

Again, all things are not ſeene by light, for there are ſomethings which are made conſpicuous onely by darkneſſe, but in too cleere and ſplendide a light they flye from the Senſe, as the Scales and eyes of Fiſhes, olde rotten wood, yea I ſay the Stars themſelues, which therefore the vulgar imagine do fall becauſe they be obſcured by the light of the Sunne and ſo taken from our ſight, but at the returne of the Euening twylight, (to wit) vvhen the light goeth avvay and the night approcheth they are by degrees reſtored to our ſight again, as in the morning tvvylight they after the ſame manner doe vvithdravv themſelues by little and little from vs. Therfore euery thing vvhich is ſeen is not light or ſeen by the light.

Some things are ſeene in the darke.

How the Starres are ſeene.

Reaſon and *Ariſtotles* doctrine doe contradict this opinion: for vvee are taught by both theſe that the Eye ſhould be free from his owne obiect, that ſo it may receiue it more ſincerely, but the Eye both in regard of his whole frame and compoſition and eſpecially in reſpect of the criſtalline humour, where the reception of the obiect is properly made is eſpecially light and cleare, light therefore cannot be the obiect of the Sight.

Light is not the obiect of the Sight, becauſe it is in the eie.

Moreouer, *to ſee*, is not onely to know a thing with the Eyes (for this is too large a a ſignification, and agreeth to many things beſide the proper obiect) but wee doe properly ſee that in which (when it is perceiued with the Eye) the ſight is determined and ſtayerh it ſelfe. But the ſight is not terminated in the light, though the Eyes doe *perceiue* it but reacheth alwayes beyond it. Seeing therefore the light cannot be truely ſeene, it canot bee the true obiect of Sight.

Furthermore, an incorporeall obiect cannot alter a corporeal Organ, except it proceede from a body, that is, be a quality thereof, and then that alteration is attributed to the body by the meanes of the quality; but that viſion be made it is neceſſary that the Organ be altered by the obiect; the light therfore becauſe it is a bare quality (though they deny this) is not to be thought the obiect of Sight, but ſome other corporeall body wherein there is a viſible quality.

The alteration of the Organ is requiſite to viſion.

Laſtly, the Organ ought to bee potentially that which the Obiect is actually, but the light is actually incorporeall, and no corporeall body is potentially incoporeall, vnleſſe by the means of ſome actiue qualities, but no ſuch actiue powes proceedeth from the light but illuminatiue and enlightning, whichthey think hath the Nature of an Obiect. But they ſtil obiect that al viſible things muſt be reduced vnto ſom primary *genus*, which may be called an obiect. Seeing therefore light is thefirſt of all, becauſe by the helpe thereof others things are ſeen, but light needeth no other helpe, therefore worthily all other viſible things ought to bee referred vnto light asvnto their primary and chiefe *genus*, and ſo it remaineth that light is the firſt and proper obiect of Sight.

The Organ ought to be potentially the Obiect.

But beſides that it is denyed that all viſible things are ſeene by the helpe of Sight, as we ſayd before, yet though we ſhould grant ſo much it would not follow that all obiects are to be referred vnto the light as to their firſt and chiefe *Genus*. For viſible things are not therefore ſeene, becauſe they are illuſtrated and made bright by the light, but becauſe they haue another affection which can alter the Viſiue faculty. Wee grant therefore that light doth neceſſarily concurre vnto viſion, but we deny that it is the immediate cauſe therof. Moreouer, it is true that thoſe things which mooue the viſiue Faculty ought to be reduced to ſome one principall *genus* which is called an Obiect. Yet all viſible things both proper and inproper with all which do any wayes fall vnder the Sight cannot be referued vnto any one *genus* and therefore not vnto light.

Whether all Obiects be reſtrained to the light as to the generall.

After what manner viſible things be ſeene.

QVEST

QVEST. XXXI. *Of the Nature of Light and what it is.*

Their reasons which proue light to be a body.

BVt there are some make opposition; when wee say that the Light cannot mooue the Sight because an incorporeall thing cannot change a corporeall Organ vnlesse it be disposed and fitted by certain *media* or meanes vnto that alteration, but light hath no actiue power beside illumination. I say against this some oppose and would proue that Light is a body: first therefore they retort our owne argument vpopn vs. For as wee conclude that the Light cannot alter the visiue faculty; so they inferre on the contrary that it is therefore a body because it doth alter the eye; and that it doth alter the eye they conuince by experience, to wit, because the light doth trouble the eyes by mooving and tossing their spirites and so causeth some payne and griefe in them, which things cannot bee done without alteration which is proper vnto bodies; they therefore by good right conclude that the Light is a body.

That light doth alter the eie.

Answere.

I answere (sayth *Placentinus*) that though a body be continually requisite vnto alteration, yet that alteration is not of the body as it is a body, but as it is such or such a body and so qualified; as for example; the fire doth heate not as it is fire but as it is hot: and as the heat it selfe doeth proceede from the fire and doeth alter cold things which are a good way distant from it, that is, make them hotte: so also the Light yssuing out of a lucide and cleare body doth trouble the eyes and produceth other effects aboue named. But as the heate of that fire is not a body but a quality of the body; so also it is not necessary that this Light be a body. VVe confesse therefore that alteration indeede cannot be made without bodies, yet this alteration is not to bee ascribed to the bodies but to the qualities of the bodies. In that therefore the Light doth alter the eye, it is not because it is a body, but because it is a quality of a body.

This therefore maketh nothing for them which would haue the Light to bee the obiect of Sight: for the Light alters the Sight as it is a Light, that is, by illuminating, but this is not sufficient vnto Sight; for then heate, colde, humidity, siccity and other qualities should bee the obiects of Sight, because that all these doe alter the eye.

How light doth alter the organ of sight

First reason of the contrary.

But beside these reasons there be almost innumerable others which doe conuince sufficiently that Light is not a body, and they are especially drawn from the conditions of bodies which doe continually and necessarily agree vnto them. For first of al, euery body is moued in a certaine time and successiuely, because of the resistance of another body; for one body cannot be mooued vnlesse it driue and force another which did before exist in the place to which it is moued: for because Nature doth aboue all things abhorre vacuity or emptinesse, it must needs be that in euery place there must be a body. But the light not in any distaunce of time nor successiuely, but in a very moment doeth repleniſh the whole Hemisphere and Horrizon by a sodaine diffusion, and doth go through the whole space from the East vnto the VVest with out any progression of time; whence it doth necessarily follow that it is no body.

But the light is not so moued.

Secondly, euery body hath his proper circumscription and treble dimension, but this circumscription and these dimensions are not at all competent to Light, vnlesse you will attribute them to the light in regard of the body wherein it is, but then it doth agree therto onely by accident.

To this we will adde that there is no body in Nature which is not diuisible into infinit parts; but who could euer deuide the Light.

Moreouer if it were a body some motion which bodies haue would agree vnto it; for all bodies are either mooued vpward or downward or circularly: but no such motion can be ascribed to the Light. It followes therefore that it is no body.

Againe, if it were a body it should bee either coruptible or incorruptible. But corruptible it cannot be, for then some thing should bee generated of his corruption, because the corruption of one thing is the generation of another, but nothing is generated of the corruption of the light, for if there were it would appeare seeing the light is so vast & immēse. Neither yet is it incorruptible, for we see that when a Candle is put forth, the light is extinguished. But if we should graunt it to be a body, how would our aduersaries auoyde those absurdities which would follow there-from? Should not there bee a penetration of bodies? For the light doth penetrate all the parts of the perspicuous body, and yet the nature both of the light and of the body is preserued whole and entire. Seeing therefore that nothing is more impossible then this penetration of Diameters, as the Mathe-

Penetration of bodies impossible.

maticians

maticians auouch, it is also altogether impossible that light should be a body.

Now that we know what this light not is it followeth that wee make inquiry what it is, which that wee may obtaine wee will make a reduction into the highest *genera* or kindes which are two. For whatsoeuer doth exist in the whole Vniuerse is either a substance or an accident.

A substance this light cannot be, for it doth not subsist by it selfe, but if the lucide or bright body be remooued the light is also taken away: neither can it be separated from the lucide body. Moreouer, no substance of it selfe is vnder the perception of sense, but light is by it selfe perceiued by the sight: and this no man can deny, because it is neither knowne by Touching nor Tasting nor Smelling, nor yet by Hearing, notwithstanding it is knowne; it remayneth therefore that the sight doth iudge of it, and yet it is not therefore the obiect of Sight as we haue before shewed.

What light is
Euery thing is either a substance or accident.

Seeing therefore the conditions of a substance doe in no sort agree to light, it is necessarily inferred that it is an accident; which notwithstanding many vncertain wits and ignorant do deny, grounding themselus vpon this argument, that if it were an accident. Then light would mingle it selfe with light in the same subiect, but it is not mingled, for there doth some distinction appeare betwixt the light of the Sunne and of a candle when they are both together.

Obiection.

Secondly, they produce an example of two candles which make two shadowes out of one darke body; but if the light of the one should be mingled with the other and so bee made as it were one, they would also onely make one shadow of one body.

Second argument.

But it is not so as they say. For, that the light of the Sun is not mingled with the light of a candle, doth not happen because it is no accident, but because these two lights are not of the same kinde, for the one proceedeth from a body more pure and simple, the other from a more impure and materiall substance so that it seemeth after a sort mingled with smoke; and as a pure thing vpon an impure rideth aboue and remaineth distinct, least that which is immaterial should be mingled with that which is materiall; so it is impossible that that the accidents of an immateriall thing should bee mixed and confounded with those which belong to a materiall body, and this is the reason why the light of the Sunne is not mixed with the light of a candle.

Answer to the first
The light of the Sun is not ioyned with the light of a candle.

That which they add of two candles doth require another Solution; for the light of two candles is of the same kinde, but I vtterly deny that they are not at all mingled if this word *mingled* be rightly vnderstood for any mixture or confusion; for the light of one candle cannot be discerned from the light of another but onely by their shadowes; and for this I referre you to your senses for the triall, because we treate of a sensible matter; for take two candles and shew me the light of the one and of the other, thou shewest the shadowes, and why? because thou canst not discerne the lights one from another.

Answer to the second.

But the reason why two shadowes do appeare, is, because that the lucide bodyes doe send foorth their lights by right lines, and though their light bee mingled, yet they keepe the rectitude and streightnesse of their ownelines. When therefore a darke place is opposite to two lucide bodyes, it is of necessity that it send foorth two shadowes, not that the shadow is formed of the light, but because the darke place is illustrated onely in that part where against the lucid body doth directly shine, otherwise hindring the light that it cannot reach vnto the backe thereof, which therefore casts an obscure shadow. So in the time of the Eclipse when the Moone for want of light seemeth to faint away, this hapneth because the light of the Sunne cannot attayne vnto her according to his wonted manner, be reason of the interposition of the earth betwixt them. For that obscurity which is perceiued in the Moone is the shadow of the earth; for if the shadow it self should proceed frō the light; then at noone day when the horrizon is perfectly illuminated there could bee no shadow at all, because there is no reason why it should be made, rather on the one part of the obscure body then on the other; nor why the light should obscure or cast a shadow from one part of the darke body rather then from the other.

Why there be two shadowes of two candles together.

The shadow is not from the light from the darke body.

But to the matter; I say that the cause why there remayne two shadowes, although the lights do mixe together, is the streightnesse of the lines whereby the light is sent from a lucide or bright body into a darke, so that it alwayes leaueth the hindpart thereof darke whence the shadow commeth. And that this is true it is hereby manifest, because the shadow is mooued according to the motion of the lucide body, as also after the motion of the darke body which casteth the shadow. So that alwayes there is a shadow at the backe part

The streightnes of the lines is the cause why there be two shadowes.

and

and that which lieth oppoſite by a right line againſt the lucid body is alwaies enlightened. Yet theſe two ſhadowes will not be ſo obſcure as if there were but one, becauſe either of them is much illuſtrated by the light of the other lucid body by which it is not produced. And ſo much of the nature of Light.

QVEST. XXXI. *Of the difference betwixt Lux or Light it ſelfe, and Lumen or Illumination.*

That they differ in kinde.

THoſe which do peremptorily perſiſt in the defence of the intentionall or imaginary eſſence of light, hold that *Lumen* or the Illumination and enlightning is a ſpecies or kinde of that we call *Lux* or the *Light*. For, as the *colour* and the *ſpecies* do differ in kinde, ſo in like manner dooth the light it ſelfe differ from the *Lumen* or enlightning, becauſe as colours by their ſpecies becomme ſenſible, ſo the light is ſeene by the illumination of it as by his ſpecies or forme. But we conſent not with them: for if light were ſeene by illumination,

This opinion improoued.

then this illumination would not fall vnder the Senſe; for the ſpecies of ſenſible thinges are not themſelues perceiued but they are that whereby the obiects do moue the Senſe; ſeeing then the *Lumen* is ſeen by it ſelfe it cannot be that the Light ſhould through it attaine vnto the Senſe.

Obiection.

But they further obiect, that the *Lumen* or enlightning is in a tralucent bodie, and the light or *Lux* in a darke bodie, and that therefore they differ *in ſpecie* or in kinde one from another.

Solution

But I anſwere that it is not ſo; indeede we grant that the *Lumen* is in a tralucent or bright bodie, but we confidently denie that the light is in a darke bodie, for it is alſo in a tralucent body, yet in a ſubiect more denſe and darke then that of the *Lumen*, for the light it ſelfe is more darke then the illumination: therefore ſaith *Ariſt.* it doth determine or limit the ſight, whence it hath the name of a colour. For hee calleth light white in the booke *De ſenſu & ſenſili*, and alſo in the fourth chapter of his firſt booke of Meteors hee calleth the Sun white. But the matter is cleere of it ſelf, for we perceiue that our ſight is terminated in a flame, in the Sun, or in the Moon, neither are any other colours brought vnto vs through them.

Obiection. Anſwer.

But it may be obiected that light ſeemeth to be permanent and abiding in the ſubiect, but the *Lumen* is not except in ſome cleare, bright body. I aunſwere it is true, but yet this doth not argue a ſpecificall difference: for as the heate being proper vnto the fire doth abide therein, and the other heate which is produced from this dooth vaniſh when the fire is remooued from it, yet they differ not in kinde, ſo neither doth *Lumen* or enlightening differ from *Lux* or the fountaine of this Illumination.

But there be many reaſons why they do not differ in kind one from another. For ſometime the *Lumen* or illumination dooth aſſume to it ſelfe the nature of *Lux* or Light. So

That *Lux* and *Lumen* do not differ in kind

the Moone hath light which is manifeſtlye nothing elſe but the very enlightning of the Sun. But do they not at all then differ? I ſay they differ, yet in the Planets not truely but onely in reſpect. For example, the Moone as it doth enlighten the earth hath Light, but as it receyueth this light from the Sun it is onely an illumination; and hence it is that ſome illumination hauing a conuenient dark body oppoſed to it will becom light & ſend an illumination out of it ſelfe: But if you let it bee without a darke body it will be onely an illumination. Euen as the Elementary fire in his proper place is commonlye called *Lumen* and yet is not ſeene becauſe it hath no darke body, that ſo it may tranſmit her illumination to vs, ſo that light is no other thing but a condenſed illumination, yet not ſo that it doth degenerate into a colour.

Why the elementarie fire is not ſeene.

Moreouer, they differ in the ſubiect. For this *Lumen* or illumination in his proper ſubiect is *Lux*, that is, a Light; but being without it, it is a meere illumination, that is, Light is properly called that which is in a lucide or bright bodie, as in the Sunne and in other Starres; but illumination is that which is produced from the light, ſo that in the ſun there is not illumination but light, and in the aire there is no light but *Lumen* or illumination onely.

QVEST.

QVEST. XXXII. *That colour is the Obiect of Sight.*

ALL the Authors which euer writ of the Sight, haue determined with one consent, that colour is the proper Obiect thereof, herein following the steps of *Aristotle* who hath beene their leader and guide. For in the beginning of the seuenth Chapter of the second book *de Anima*, he writeth on this manner. *That which is visible is colour, and this colour is that which is in it that is visible. And it is visible* per se, *or by it selfe: that is to say, it hath the cause within it selfe which makes it visible.* Where he not onely describeth the common Obiect of Sight: but doth presently after restraine it vnto a proper Obiect; to wit, that which hath the cause of visibility (if I may so say) in it selfe: but the cause of visibility is to bee able to mooue the *perspicuum* or tralucent body, that is to imprint his Species in the *perspicuum*, by the meanes whereof the Sight is moued, and therfore he addeth immediatly these words. *All colour is motiue, or able to mooue that which is actually tralucent, and this is the Nature thereof.* If therefore the colour doe by it selfe moue the transluce body, which is the proper cause of visibility, it must also bee accounted necessarily for the proper Obiect of Sight. For neither illumination, nor light, nor any other thing by it selfe can moue this Sence, vnlesse in some part it be answerable vnto colours, and then the effect is neuertheless due vnto the colour.

Colour is the proper obiect of Sight.

Arist. authority.

Adde hereto, that the proper Obiect of Sight must be of that nature, that in it the Sight may be determined; and may rest to forme the visiue faculty; and wherein if neede require more accurate inspection, it may stay and rest it selfe. But no such thing can bee found in the whole frame of Nature besides colours.

Another reason to proue it.

Againe, by the Obiect of Sight all mixt bodies doe become visible, but this is accomplished neither by illumination nor light, nor by any other thing, but onely by colours, and therefore they are the proper Obiect of Sight. It is true indeede that things are made visible in the light, yet not by the light, that is, light is no sufficient cause of vision, because it is not able, nor apt to moue the tralucent body, but onely the forme of the *perspicuum*, for when we say that colour is able to moue the *perspicuum*, we doe not vnderstand that it is the Act of it, but that it affects and moues it by a visiue *species*, and this is peculiar to colours alone.

Lastly, all things which be visible do fall vnder the sight of the Eyes, by the accidents which are in them; after the same manner whereby wee attaine to the knowledge of any thing by another quality; but neither illumination, nor light, nor any thing before mentioned is in visible things but onely colour, therefore wee knowe not thinges by them but by the colour.

3. Reason.

Seeing then that the obiect of Sight ought to be such, that thereby we may come vnto the knowledge of visible things, none of these but onely colour is to be accounted the obiect of Sight, for this is in all things and doth immediately follow the miston of Elements.

I might adde that in euery obiect there are diuers *species* to be required, as contrary, intermediate and some alike, because there is no election, choyce or dignotion of one simple thing. But there are no differences of Illumination nor Light nor of other thinges which wee haue rehearsed, much lesse are there contrarieties. For illumination doeth not truely differ from illumination, nor Light from Light; neyther is illumination contrary to illumination, nor Light to Light; but there are diuers differences of colours and one colour is contrary to another; not those therfore but this, to wit, colour is the obiect of sight.

The variety of kinds is required in euery thing.

QVEST. XXXIII. *Whether Colour be Light.*

BEcause Light as wel as Colour doth determine the Sight, and hath in it selfe a cause of visibility, hence some thinking that there ought to be but one obiect of one knowing and discerning faculty, haue esteemed Colour & Light to be of the same Nature. But this cannot bee, for all Colour is not Light, neither is all Light Colour; whereas if they had beene of the same Nature, they might haue beene conuerted reciprocally.

Of one faculty must there be ons obiect

But they vrge thus. *Euery thing which is seene is colour, but Light is seene therefore Light is colour.* I answere, to bee seene may bee vnderstoode two wayes: first commonly and improperly, so as euery thing both colour and that which is proportionable thereunto is sayde to be seene. And so *Aristotle* taketh it in the 2. Booke *de anima*, and his Chapter *de*

visu, where in the beginning he sayeth *That which is visible is colour, and that which is without name*: as if he should say, *That which is proportionable vnto colour*: and after this manner Light is seene and yet is not therefore a colour, because that on this manner many things may be seene which are not colour, but onely proportionable vnto colour.

Secondly, this word *Seeing* is taken properly, and according to this acception nothing can be seene besides colours.

Obiection. But they add yet further that the same effect belongeth to the same cause; but whitenesse and light do performe the same effect, for a white colour doeth dissipate the sight and weary the Eyes, and the same effect doth the light worke, wherefore light and a white colour doe not differ.

But we deny this argument. For though there be great affinitie and likenesse between whitnesse and the light, as also betwixt blackenesse and darkenesse, yet no Identity nor vnity of the species or kind doth hence ensue; for if the case were so, two lucid bodyes would produce colours of two kinds in one and the same darke body; because they can neuer shine equally and alike: but to shine were to send forth a colour. Againe, when the light faileth, that is, when darknesse begins to come; first a greene colour, then a purple and so other intermixed colours must bee induced vppon the darke body till at length it attaine vnto the quite contrary colour, to wit, blackenesse; euen as the light doth mediatly and by degrees degenerate into darkenesse. But nothing can be more absurd then this; for wee see that a white colour remaineth white, vntill the least part of it may bee seene, yea it abideth white til it be so dark that we can see nothing, & all colours are taken away from our eyes.

That colour is an illumination. Others with more shew of truth haue vndertaken to perswade that colour is *Lumen* or an illumination, which opinion they strengthen with no small arguments. First, because when this illumination is absent colours cannot be present, and againe, at his arriuall or returne they are generated in the bodyes.

But this argument is of small force, for *Lumen* or illumination doeth not generate colours in bodies; neither when it departeth doeth it take them away, but is onely the cause wherefore they are rather sensible when it is present, and being absent they are not seene. The reason is because without this splendour colours cannot moue the tralucent bodie, and so the night doth not take away the colour but the images of it which are as it were the deputies or instead of the colours: but the reall colours which are by themselues visible doe remaine, if not actually yet potentially.

Yet they vrge further: that we see by experience that the cloudes by the diuers irradiation or glittering of the Sunne sometime are of a white and sometime of a red colour: as also is the Rainebow: for which cause also we see the Sea sometime to waxe purple coloured, sometime to become gray, and a farre off to shew white, and at hand blacke. Finally, the necks of Doues and the tayles of Peacocks doe wonderfully varry their colours by the diuers aspect of the Light. But none of these are thus indeede and in trueth, but doe so appeare by reason of the vehement splendor of the Sunne, or of the leuity of the coloured bodie; whereuppon the Sight is somewhat hindered that it cannot discenrne off and know the reall colours as they are.

Againe, this hapneth not only from the direct or indirect irradiation of the Sunne, but also from our beholding of the coloured thing from on the right hand or from on the left, forward or backward. For it is greatly to be respected whether the shadow of the coloured thing bee on our side or on the opposite: and therfore according to the motion of the Peacocke so the colour of her trayne seemeth to be varried: which thing Painters when they goe about to Limne any picture doe diligently obserue, marking the place wherein the life is placed: to wit, in what part it doeth receiue the light. Moreouer, they consider the entraunce into the place where it is, that they may resolue on what part they may best behould it: well knowing that both our eye and the light should bee well disposed vnto the right perception and discerning of the reall colour. For if a well painted picture be placed in an inconuenient place his forme will not appeare artificial but deformed and disordred, not that it is so indeed, but that it onely appeareth so by reason of the inconuenience of the place. And thus also it is with the colours of Peacocks, so that hence wee are taught that the illumination doeth not alter the colours, but the disordered scituation of the coloured body and of him which beholdeth it, are a great cause of the variation thereof.

A good obseruation of Painters.

QVEST.

QVEST. XXXIIII. *That the pure Elements are not coloured of themselues.*

Perspicuum or Tralucent bodie being without all darkneſſe can neuer be ſo condenſed that a colour ſhould ariſe therefrom, and therefore the ſimple Elements, yea and the heauen it ſelfe haue abſolutely no true colour: for though the aire may be ſo condenſed that it may degenerate into Water, yet it will neuer attaine vnto a colour, no nor the earth it ſelfe, nor yet that which is more condenſed then the earth; They therefore bee in an error which aſcribe whiteneſſe vnto three Elements and blackneſſe vnto the Earth: Indeed perſpicuitie and tranſparencie may be allowed to theſe three and a kinde of darkneſſe to the earth, but no colour at all. Notwithſtanding they prooue that colours do agree vnto the Elements, & eſpecially ſimple colours as white and blacke; becauſe they be ſimple, and as a mixt bodie is made of the mixture of the Elements, ſo ſay they from the mixtion of white and black mixt colours are generated. And this is their argument: *That which agreeth to any thing by participation, doth alſo agree to it by eſſence; but both extreme colours and thoſe which be intermixed do agree vnto mixt bodies by the participation of the Elements: whence they conclude that it is neceſſary that ſimple colours, that is, white and blacke do eſſentially agree vnto the Elements.* To which we will anſwere by denying the maior propoſition, for many things do belong to a bodie by the participation of another, which may not bee attributed to that body as it is abſolutely conſidered. So to the Elements which are here with vs very turbulent and confuſed many thinges doe agree, which no man of vnderſtanding dare aſsigne vnto the ſimple and ſincere Elements.

The pure Elements are not truly coloured

Obiection.

Reſolution.

As for example, Our fire which is nothing elſe but a certain kindled and flaming ſmoke, is coloured perſpicuous and bright, yet the elementary fire we imagine to be pnre & moſt ſubtle, from which as from a Fountaine ours dooth flowe, yet hath none of theſe groſſe qualities which our fire hath. For being exceeding ſubtle & fine it hath no ſolid ſubſtance admixed with it, and therfore is not affected with any colour, neither is it lucid and tranſparant. For colour conſiſteth in ſuch a bodie as doth determine the ſight, but light doth not ſhine in a ſubtile and thin body, but in a denſe or thicke body: we grant therefore for the preſent, that in mixt bodies colours do reſult or ariſe out of the concurſion of the Elements, yet it doth not thence follow that elements being pure and not defiled with the ſtaine of other compounded matters ſhould be tainted with ſuch colours as are ſaide to be in the extremities of bodies, as accidents are in the ſubiects; becauſe the ſecond qualities ariſe from the firſt which to aſcribe to theſe ſimple bodies wer very eroneous: Wherfore the Elements do not primarily generate colours in mixt bodies but ſecondarily, that is, not as they reteine their proper Nature but as they lay it aſide, and ſo do conſpire into the nature of the mixt bodie. For the Elements cannot concurre in one and ſo make a mixt body vnleſſe they ſuffer an alteration both according to their ſubſtance and according to their quality, & ſo they do as it were put off their proper being or eſſence, that by this mutuall embracing and coniunction they may produce a compound body. If therefore they neither reteine their ſubſtance nor their firſt qualities (which the ancients eſteemed as their eſſential forms) how ſhould they reſerue entire to themſelues thoſe colours which are their ſecond qualities that the colour of the mixt bodie ſhould proceede from a confluence of the colours of the ſimple Elements: wherefore colours do belong to mixt bodies primarily and by themſelues, that is, eſſentially and not by participation, and ſo we will paſſe by this argument, not medling with the ſophiſtry of their Sylogiſme, which euery one that runneth may perceiue.

How the Elements generate colours.

QVEST. XXXVI. *Of the generation of Colours and of their forme.*

Wee haue determined already that true colours are produced from the Elements mixt among themſelues and not from their firſt qualities, to wit, the heate, cold, humidity and ſiccity as ſome haue thought, though indeed almoſt all ſecond qualities do conſiſt of theſe; but colours doe ariſe from the eſſentiall forme of the Elements, from which forme (as it were a proper accident) they are deriued, that is, colour dooth ariſe out of the perſpicuity and opacitie of the elemenrs proportioned together. For three of the Elements be perſpicuous, the Fire, the Aire and the Water, yet ſo that the Fire is more tranſparant then the Aire, and the

The originall of Colours.

Aire then Water, onely the Earth is darke: when therfore the Earth is mingled with the three other, it doth determine their perſpicuity and ſo induceth a colour into the mixt body, for their tranſparency and perſpicuity is condenſed and made more craſſe and thicke, ſo that they ceaſe to be tralucent and do determine the ſight, and then colour neceſſarily followeth. For to terminate the ſight in his ſuperficies is to be coloured, becauſe nothing can determine the ſight but by ſome colour: A colour therefore ariſeth from the condenſation of a tranſparant bodie by that which is darke in the miſtion of the Elements; for when the tranſparant body by reaſon of the darke body ceaſeth to be tranſparant, it becommeth coloured and in his ſuperficies doth mooue the ſight.

That which determines the ſight is coloured.

Colour is generated of the miſtion of the darke bodie.

Hence appeareth their errour who ſuppoſe a double nature of colour is ſignified in that definition which we haue giuen, ſeeing *Ariſtotle* cals it *The extremity or outſide of the tranſparant body*; for the extremity of the tralucent body is not a color, but that which like an accident doth inhere in the extremity or ſuperficies; or if you will, the extreame outſide of the *perſpicuum* or ſplendent bodie is not the cauſe of the colour, but the colour produced from elſwhere doth by his adumbration or circumſcription determine the tranſparant body. For the *perſpicuum* or tranſparant body is that, which by reaſon of the tenuitie of his parts doth tranſmit the light and ſo appear, yet doth not determine the ſight; where therefore the Sight is determined, there the *perſpicuum* muſt end: for except it were ſo the ſight would yet proceede further beyond it; but the Sight is terminated onely by colour and therefore colour is rightly called the tearme or bond and extreamitie of the *Perſpicuum*.

VVhat *perſpicuum* is.

Of the Forme of Colours.

Many are of opinion, that there be no colours in the darke but onely a kinde of faculty and beginning whereof colours do ariſe as it were out of a matter illuſtrated by illumination which ſerueth in ſteade of the forme: Of which Sect *Epicurus* was as *Lucretius* ſayth.

Præterea quoniam nequeunt ſine luce colores
Eſſe, niſi in luce exiſtunt primordia rerum.
Scire licet, quo ſunt quæuis velata colore;
Qualis enim cæcis poterit color eſſe tenebris?
Lumine qui mutatur in ipſo: propterea quod
Recta aut obliqua percuſſus Luce refulget.

Againe, becauſe no Colour can without the Light appeare,
VVho ſhall diſcerne what coloured maskes the Elements do weare
Vnleſſe the Light do vnto him their ſeuerall hewes bewray?
And what man can the colours blaze which in blinde darkeneſſe ſtay?
Becauſe in Light all colours change, and ſhine as they are ſmit
With the Oblique or direct Rayes which from the Light do flit.

And hee maintaineth his opinion by this, that as the coloured bodie is illuminated eyther rightly or obliquely, euen ſo are the colours thereof changed. But hauing diſputed this before I now paſſe it ouer, ſo that it remaineth that we demonſtrate and ſhew that the *Lumen* or ſplendencie cannot be the forme of a colour. But firſt let vs heare the Argument which the *Epicures* bring in defence of their opinion. They ſay therefore that *Seeing the Faculty of Seeing is one and ſimple, therefore all thinges which are iudged there by properlie and by themſelues ought to bee referred vnto* One primarie genus, *and beecauſe Light cannot bee reduced vnto colour, it is neceſſary that colour be reduced vnto light.*

The Epicures reaſons that Light is the forme of Colours.

But this reaſon is ſo abſurd, that it ſeemeth not worthy the time and labour of confutation, eſpecially becauſe it no whit aduanceth the certainty of that which is in controuerſie. For they were to conclude, that *lumen* was the forme of colours, yet neuertheleſſe their argument will not ſtand; for we graunt indeede that that which is ſeene, ought properly and by it ſelfe to be reduced vnto one *genus* or head, becauſe the faculty iudging of them is one, as we haue proued before; but wee denie that illumination can properly be ſeene, or that colour may be referred there-vnto. Haue we not conuinced by that which goeth before, that whatſoeuer is ſeene by it ſelfe is a colour? Are not light and tranſlucencie perceiued improperly, to wit, onely as they are proportioned vnto a colour, as wee haue proued ſufficiently? And haue we not demonſtrated that neither light nor ſplendẽcie can be a colour? How then ſhall colour bee brought vnto the nature of light? Yea, I maintaine

All the Obiects of Sight ought to bee reduced to one head.

maintaine the contrary, to wit, that illumination may and ought to bee reduced vnto colour, becauſe it becommeth viſible no other way then as it obtayneth ſome proportion with colour. The light is referred to the colour.

But in the meane time ſome doe obiect, *that Colour is ſaid to be actually the extremitie of the tranſparant body, that is, not of the tranſparant body as it is tranſparant, but as it is an illuminated tranſparant body; becauſe without light both the colour and tranſparant body are only in* potentia *and poſsibility. Seeing therefore that the light doth enduce an actuall being vpon the colour, it will follow that light is the forme of colour, becauſe the act of a thing is the forme of it.*

How that of *Ariſtotle*, namely that colour is the extremity of the tranſparant body, is to be vnderſtoode, wee haue ſhewed before, but where it is ſaid that light doth actuate colour, I anſwere, that light doth not actuate the colour as it is conſidered in it owne Nature as a colour, for a colour remaineth a colour euen in the darke: it is true indeede that it maketh the colour actually viſible, neither doe we denie it; but if it were the forme of the colour it ſhoulde not onely make it viſible, but what Eſſence ſo euer colour hath it ſhould of neceſsity haue receiued it from the light: but we haue taught already that the whole Eſſence of colour proceedeth from the foure Elements. Light is not the forme.

Moreouer, it cannot be that this Light ſhould be the forme of colours. Firſt, becauſe the forme ioyned with the matter doe conſtitute one compounded body: but light and colours are in diuers ſubiects. The reaſon thereof.

Againe, who euer ſaid that one accident was the forme of another? but light though it be ſomething more then a meere accident, yet it ſauours moſt of an Accident, and therefore cannot be the forme of a colour.

Laſtly, if Illumination were the forme of colour, then colours ſhould not differ in *Specie*, for whether the light be ſtrong or remiſſe, whether it be direct or refract and broken it is alwayes of the ſame *Species*, but we ſee that colours be not onely diuers but alſo contrary, therefore light cannot be the forme of colours.

But the Epicures would make vs beleeue, that this variety of colours proceedeth from their different originals and beginnings which they eſteeme to be their matter. Surely, an opinion vnbeſeeming one which carieth but the name of a Philoſopher, for can you take the differences of things from their matter? Know you not that the ſpecificall difference of things doth flow from the forme? Is it any matter which diſtinguiſheth a man from a beaſt? No: but the vnderſtanding or reaſon. Now reaſon is the forme of a man, not his matter. And this wee may learne by mechanicall Arts, for the ſame workman out of the ſame matter doth forme both an Altar and an Image, and theſe differ one from the other, not becauſe they conſiſt of a diuers matter, but becauſe a diuers forme is giuen to either of them. All difference is taken from the forme.

To theſe we will add, that Colours are another thing then the light. For colours work vpon the light touching the illuminated aire; as may appeare in a Looking-glaſſe receyuing colour brought vnto it through enlightned aire; ſo alſo the greenneſſe of Trees and Medowes doth appeare in ſuch bodies as are oppoſite vnto them, which could not be except the colour ſhould worke vpon the Light; but who euer ſaide that the things formed did worke vpon the Forme? How a glaſſe receiueth Images.

QVEST. XXXVI. *Of the Medium or Meane of the Sight.*

NO man euer doubted whether the Sight ſtoode neede of a Meane, but all reſt vpon experience, which no man well in his wits will contradict: For if you lay any colour vpon the Eye it will not bee perceiued, and if that ſaying of *Ariſtotle* be true in any Senſe, it is eſpecially true in this Senſe of Sight, to wit, that *the ſenſible thing being laide vpon the Senſe doth make no Senſation.* Therefore wee ought not to doubt that the Sight hath neede of a *Medium*, eſpecially being here-vnto perſwaded by reaſons beſides experience. For Sight is a ſpirituall Senſe, and therefore cannot perceiue materiall things as they are materiall, but it diſcerneth their *ſpecies* receiued in the Meane, and how could materiall things ſend forth theſe *ſpecies* if there were no *meane* betweene the Obiect and the Organ: I ſay if there were not a *Medium* which might draw out and receiue the *ſpecies* or formes. A viſible Obiect impoſed to the Eyes is not ſeene. The reaſons why it needeth a *Medium.*

No bodie is the Meane of Sight. Neither compound

It remaineth therefore that we make inquiry what that is which is a competent *medium* in the Senſe of Seeing. Firſt, it cannot be a body; for euery bodye is either Simple or Compound. A compound body it cannot be, becauſe all compound bodies bee coloured and by conſequent are an *Obiect* and not a *Meane*; neither can any of the ſimple bodies be accounted for a *Meane*, for they bee the foure Elements, Fire, Aire, Water and Earth.

Fire is no *Medium* for we can ſee without it, nor yet the Aire becauſe we can ſee Obiects which are in the water, and this is the reaſon why the other Elements are not fit for this function, for a true *meane* muſt be in the middeſt betweene all viſible thinges, but the Elements are not ſo, no nor the heauen it ſelfe. It followes therefore that none of theſe may be accounted for the *meane* of ſight.

Nor Simple.

Perſpicuity is the true *mean* of Viſion.

It is therefore ſome accident which we muſt reſolue vpon to be this *Medium*, as appeareth by that which we haue ſaide; and all men do with one conſent acknowledge this accident to be Perſpicuity or Tranſparancy, ſo that we need not to doubt thereof. But becauſe this Tranſparancie as it is an abſtracte and an accident is not ſufficient for the performance of this function, for that the obiects doe require a certaine definite affection in the *medium*, that ſo they may be carried to the Inſtrument, whereby the conſent and agreement may bee preſerued, and that there may bee a Connexion and knitting of the extreames, to wit, of the Obiect and Organ by the Meane. We muſt therefore finde out what it is that doth aſsiſt and helpe this perſpicuity. And this is nothing but the ſubiect of it, ſo that we do not admit ſimply the perſpicuity but the perſpicuous bodie as it is tranſparant for the true Meane of the Sight, that is, not the abſtract onely but the whole concrete as it hath perſpicuity in it, ſo that wee are to conſider in it both his Matter and his Forme.

Not perſpicuity but the perſpicuous body is the Obiect of Sight.

The *Etimon* of *perſpicuum*.

The matter of the tranſparant body is not one and the ſame but diuers and manifolde, I ſay, euery thing which is peruious and may be perceiued without obſtacle or reſiſtance, for the *perſpicuum* ſeemeth to be deriued *a perſpiciendo* or perceiuing, as a tranſparant body *a tranſparendo* becauſe all things do tranſpare and appeare through it. It is therefore nothing elſe but a kinde of ſubſtance, not craſſe nor denſe, but thinne, rare and ſubtle, and eſpecially apt and fit to receiue the Illumination and the colours of other things, as are the Aire and Water and alſo many other ſolide bodies, as Glaſſe, Ice and ſuch like, as the Philoſopher witneſſeth in the 68. Text of his 2. booke *De Anima*.

QVEST. XXXVII. *Whether Light be the Forme of that which is perſpicuous.*

Whether the *perſpicuum* periſh with the light.

WE haue taught before that Illumination is the Forme of the perſpicuous bodie, but becauſe the light doth very eaſily recede and goe away ſo that darkeneſſe doth ſucceed and eaſily returne, it may worthily be called in queſtion, whether at the departure of the light the perſpicuous body doth alſo periſh and ceaſe to be, and is againe generated with the returne of the Light or Illumination.

For my owne part that I may ſpeake ingeniouſly, I am perſwaded that it is not corrupted wholy, but onely after a ſort ſeemeth to periſh, for whatſoeuer is depriued of his eſſentiall forme is ſaide to periſh. It ſeemeth therefore that the perſpicuous body may bee ſaide to periſh when at the receding of the light darkneſſe doth enſue: which darkneſſe is a priuation of that light which was the eſſentiall forme of the *perſpicuum*, I ſpeake of a body actually perſpicuous, becauſe the action, or if I may ſo ſay, the actuality of it ceaſeth when the light fadeth, yet notwithſtanding it remaineth in *potentia* or in poſsibility: for the enlightning dooth not induce any ſubtilty or tenuity of the ſubſtance: and whatſoeuer is thus perſpicuous is alſo potentially perſpicuous in the very darke, for ſometimes darkeneſſe ſometimes light are in perſpicuous bodies, as *Ariſtotle* ſaith in the 69. Text of the 2. Booke *De Anima*, where he defineth a potentiall perſpicuous body.

The *perſpicuum* is potential in the darke.

But there is yet another doubt of greater waight. For becauſe the Light is an accident, to witte, a quality proceeding from the lucide body, how can it bee the forme of the perſpicuous body, in regard that to bee a Forme of any thing is peculiar to a Subſtance? How then can that giue any eſſence or being to another which hath no eſſence at all of it owne, for the Light hath no beeing of it ſelfe but doth perpetually depend vpon the Lucid bodie, and therefore how ſhould it giue an eſſence to the *perſpicuum*? I grant indeede

A Doubt reſolued.

Anſwere.

that

that the light may bee called a quality of a lucide body, yet I denie that it is nothing but a meere accident. For all accidents haue their being in ſome ſubiect, and out of the ſame are nothing: but *Illumination*, though it doe depend perpetually vpon ſome lucide body, yet it doth exiſt out of it, and doth onely in reſpect differ from that *Lux*, which is as it were the fountaine of it as before we haue ſhewed, and wee ſee that this Illumination is diffuſed through the whole Hemiſphere, which could not be if it were a mere accident, & had no proper Eſſence of it owne; for no accident doth ſpread ſo farre from his Originall or Subiect.

The eſſence of an accident is in another.

Light is not a meere accident.

VVe ſay therefore that *Lumen* out of the lucide body hath a certaine proper being of his owne, and in that regard is ſayd to be the forme of the *perſpicuum* or tranſparant body, for which cauſe ſome call it *The imitation or reſemblance of a lucide body in a perſpicuous medium.* But as it is in the lucide body and doth depend vpon it as vppon his originall, it is not without ſome reaſon called a quality of the ſame lucide body.

How the light is a quality.

But ſome argue againſt this on this manner: That the light cannot be the forme of the *perſpicuum*, becauſe it alſo receiueth the darkneſſe into it: if therefore illumination be the forme of it, then that which is contrary to it, to wit darknes, would in like manner ſupply the place of a forme, and ſo one thing would haue two formes.

Obiection.

But the conſequence is falſe; for though the perſpicuous body doeth receiue as well darknes as light, yet not after the ſame manner, for it receiues the one as his forme, the other as the priuation of that forme; Light as his Act, and darknes as the priuation of that Act.

Solution.

For darkneſſe is not contrary to light but a priuation of it, and indeede no other thing but an abſence of Light from a ſubiect which is fit for illumination.

What darknes is.

But *Auicen* ſayth that the Light is not receiued in a perſpicuous but in a darke body and coloured, which body when it is outwardly illuſtrated, then hee thinks that the perſpicuous body is illuminated, and hee would haue this perſpicuity to note nothing elſe but a priuation of that which hinders the Light, & then that *perſpicuũ* is preſent when there is nothing to hinder the colour that it might not be illuminated. If then the Light bee not receiued in the perſpicuous body, it cannot by any meanes be the forme thereof.

Auicens opinion.

But though there bee many learned men of this opinion, yet I cannot ſtay my iudgement vpon it for ſome perſwaſible reaſons which mooue mee to thinke contrary. For nothing can paſſe from one extreame vnto another, vnleſſe it paſſe by the mean which is betwixt them; and it cannot paſſe through the *Medium* vnleſſe it be firſt receiued into it. Moreouer in a perſpicuous *Meane* there appeare diuers effects of Light; for it is attenuated and heated, which could not be if the Light were not firſt receiued into it. And by this we may eaſily gather the inſufficiency of *Auicens* conceite. Thus much concerning the difficulties about the Eyes. Now let vs come to the Senſe of Hearing.

Refuted.

QVEST. XXXVIII. *Of the Production of a Sound.*

ARiſtotle in the firſt Chapter of the fourth booke, and in the ſixt Chapter of the ſixt booke of his *Topicks* ſaith, that the knowledge we haue of any *ſpecies* dependeth vpon the knowledge of the *Genus*. Seeing therefore that the voice is a certaine *ſpecies* of Sound, and as it were an ofspring propagated there from, it muſt needes bee that it ſauour much of his originall and beginning. Wherefore before we come vnto the knowledge of a voyce, which is the moſt particular Obiect of the Senſe of Hearing; it is very neceſſary that we præmiſe ſomewhat concerning the production of a Sound in generall, for by that meanes our knowledge of this Action of the Soule, I meane the Senſe of Hearing will bee better guided and perfected.

Why the production of a Sound muſt goe before the definition.

Wherefore we will firſt ſhew you the manner of the production of a Sound. Secondly, the definition of a Sound. Thirdly, the differences of Sounds. And laſtly, we will vnfolde ſome difficulties which may otherwiſe breede ſcruple in vs. I know well that in other things the playneſt way of teaching is to beginne with a definition, but becauſe a Sound, is as wee ſay *ens fluxum*, that is, ſuch a *being* as is then onely exiſtent while it is a doing and in the time of his generation; it muſt needes follow, that when the generation or manner of production is ſufficiently knowne, the nature and definition will bee better vnderſtoode.

Hence it was that *Ariſtotle*, when hee would deliuer the Nature of a Sound, began his

Treatiſe

treatise at the maner of production,& so will we,insisting in his footsteps,which although we cannot attaine vnto yet we will a farre off adore.

3. Things required to the production of a sound. Two bodyes. A *medium*.

As therefore no sound is made without two bodyes mutually impeaching or offending one against another,as euen our Sight and Hearing doe sufficiently teach vs, so our minds also may conceiue that without the mediation of a third thing which should be not onely the *medium* wherein a concussion is made,but also the materiall cause hauing in it a *power* of sounding materially, there can no sound at all by the concussion of those bodyes be produced.

The necessitie of this *medium* or third body which must come betweene in the collission of 2. hard bodies which make a sound may be thus demonstrated. If two bodies meet one of them must mooue and apply vnto the other. Now wee know that motion cannot be made without a *medium*. Againe, that this *medium* or third body must haue the faculty of sounding materially therein,is prooued,because though two bodyes offend one against another, yet if they be sharpe or soft they make little or no sound at all, so a Needle against a Needle,wooll against wooll doe not sound. The reason of the first is, because there is no quantity of this intermediate matter to make an impression off;the second,because though there be a collission yet there is no resistance.

Many instances to proue that there must be a *medium*.

Moreouer,things that are vnequall or rugged doe not sound well, neither doth a plaine thing make a full sound, for the more cauity there is in the body that is beaten (so it be proportionable to the violence that is offered) the more resonant is the sound. Add hereto,that sometimes though the collision be with greater violence, yet the sound is not so loude,for two blockes beaten together will not make so loude a sound as a little bell; and when a new peece of cloth is torne a sunder, the rash is louder then if two harder bodyes should enterfaire one against another. All these instances doe manifestly prooue that there is a third thing requisite vnto the production of a sound,which is also the matter thereof.

This third intermediate body is that wherein the concussion is made,be it Ayre or Water,or Fire, for those three bee not onely fit for the transuection of sound, but haue also in them the matter whereof it is formed,although not in an equall degree.

In concussions therefore the faculty of the *medium* or power of the matter is actuated when it is intercepted and broken betweene two bodyes offending one against another.

The manner of the fraction

The manner of this interception or fraction is thus;when two bodyes strike one against another, that which is betwixt them is so vehemently driuen,that one part of it cannot orderly mooue by succession after another,but rather one part preuents another, and before the first part hath parted from the place another is driuen vpon the necke of it, and so the motion which when it is succesiuely made, is gentle and easie,becommeth now by reason of this inordinate violence tunultuary and troublesome. Hence it is that soft & acute bodyes make no sound in their collision, because the stroke that is betwixt them doth not so disparkle or diuide the intermediate body that there should follow vpō it any interception or fraction,whereby the successiue dissipation may be preuented. Vnequall bodyes because in their hollow and depressed parts they diuide the Ayre as it were into parcels doe yeeld a lesser sound. Those that are hollow because they gather and close more Ayre which is confusedly shuffled and beaten part vpon part,do yeeld a greater and stronger resonance? Two blocks beaten one against another do not sound so loud,the reason is because the fraction is not so smart; a bell and a clapper because of their hardnesse and polished superficies doe breake the Ayre more suddainly and throughly, and so beget a louder and brisker sound. A new cloth when it is torne a sunder rasheth louder then the percussion of a harder body, because the Ayre which is about it is diuersly distracted into many parts where the manie threds are torne a sunder.

According to the differences of the former instances

It remaineth therefore that a sound is made when as two bodyes offending or iustling one against another, the *medium* wherein they are mooued endureth betwixt them a compression,that compresion endeth in attrition, that attrition in fraction,and that fraction kindleth as it were at resonance.

That the fraction is not the sound.

VVherefore,*Aristotle* sayde well in the 78. text of his second booke *de Anima* that a sound is alwayes actuated *when one thing moues against another in a third.*

But although the ayre thus beaten and broken makes a sound,yet the very fraction of the ayre is not the sound neither the next and immediate generation thereof, and herein

all

all Philosophers doe agree, particularly *Auicen.* But what shall wee stand vpon authorities, we prooue it thus.

The fraction of the ayre is a motion but the sound is not a motion; First, because a Sound is the proper obiect of the Sense of Hearing, but Motion is a common obiect not discerned by the sense of Hearing, and therefore a Sound is not a Motion.

Secondly Motion is no quality but reduced vnto other *Predicaments* as wee say in Schooles, that is, to *Action*, *Passion* or *Place*. But Sound is a quality, to witte, one of the third kind to which the obiects of the Senses are referred. Nor the motion.

Thirdly, Sound is made by Motion; so we see by experience, so wee are taught by all Philosophy; the same Philosophy teacheth vs *That nothing produceth it selfe*. Seeing then that motion produceth Sound, certainly Sound can be no Motion.

It may be obiected that *Aristotle* in the 58. Text of his Booke *de sensu & sensili* and the sixt Chapter, sayth that Sound is a Motion; but we answere that he speaketh not in a formall sense but in a casuall, that is, not indeuouring to giue the definition of a Sound but a casuall production, as if he should say; when some motion is made with such and such circumstances, a Sound will result therefrom. Obiection. Solution.

VVe will also add another Reason and that very strong which is on this maner. Those things which haue a particular existence or being one without the other, are in themselues seuerally distinct and diuers. Now the sound and the breaking motion of the ayre haue seuerall and particular beings, because the sound is diffused and attaineth to those parts of the Aire or water, to which parts the motion cannot reach. And this *Aristotle* in his fourth Booke *De Historia Animalium* prooueth by the example of Anglers, who in the time of their disport are as silent as may be, and yet the Fishes heare them. Now saith *Aristotle* it is not like that their whisperings can produce so vehement a motion that the partes of the Aire broken thereby should by succession mooue thorough the whole masse of water vnto the Sense of the Fish. Aristotles instance.

Againe, that this fraction of the Aire is not the next and immediat generation of the sound may thus be euicted. Locall motion of it selfe contendeth or striueth onelie vnto *Place*, neither of it selfe doth it make impression of any other reall *Being* vpon that which is mooued, as *Aristotle* teacheth in the eight Booke of his Physicks the 7 chapter and the 59 Text. It followeth therefore that the generation of Sound is another action besides the motion, which action I know not how to name; yet we may wel conceiue a difference betweene the locall impulsion and the Sound, as we may also perceiue that besides locall motion sometimes heate is engendred, yet no man will say that motion is the immediate cause of heate. That sound is not immediately generated by motion.

After this manner also we may well conceiue how the influences of the Stars may be dispensed in this inferiour world. To conclude therefore it is manifest that there must concurre three actions to the production of any Sound, and these three do each accompany and succeede other. The first action is the affront which is betwixt the two bodies which offend one against another. The second is the fraction or breaking of the *Medium*. The third and last is the *sounding* of the *Medium*, for so you shall giue vs leaue to call it, because wee can deuise no other name. Immediately after this followeth the Sound.

QVEST. XXXIX. *The definition of a Sound.*

HAuing as plainly as wee could deliuered the manner of the generation and production of a Sound we will now briefely set downe the definition of it. *Aristotle* in the 65 Text of his second Booke *de Anima*, defines a sound to bee A motion of that which may bee mooued with that motion wherewith those things are mooued which do rebound from the mutual percussion of two bodies. Others do define it to be A sensatiue quality striking the hearing and the proper obiect of that Sense. But we will thus define it, *A Sound is a passiue and successiue quality produced from the interception and breaking of the Aire or Water which followeth vpon the collision or striking of two sounding bodyes, & so fit to moue the Sense of Hearing.* If any should obiect, that there is but one onely Nature of one thing, as *Arist.* saieth in the 4 chapter of his first Booke of Topickes, and that a definition is an oration expressing the nature of a thing, as the same *Aristotle* in the 5 chapter of his first Booke and the sixt chapter of his 5. Booke of Topicks saith, *There can be but one definition giuen of one and the same thing*, and therefore a Sound should not consist of one simple but of a threefolde Nature, because The definitiō of a Sound. Obiection.

we

A threefolde definition of Accidents.

we haue set downe three definitions one differing from another, whereas wee promised but one definition in the Title of this Chapter. It is therefore to be considered that three things may be obserued in all Accidents, and from the knowledge of these their Nature may be better manifested: these are the *subiect*, the *genus* and the *Cause*. By which three according to the diuers intention and end of the definer such accidentes are defined eyther with the mention of them all, or of the subiect and *genus* onely the cause being leste out, or of the cause alone omitting the other two. The first manner of defining satisfies the vnderstanding best, the other affoords but a lame & defectiue vnderstanding of that which is defined.

By the eclips

So in this definition of the Eclipse, that *It is a priuation of the Light in the Moone by reason of the interposition of the Earth betwixt the Moone and the Sunne; all three are contained.* Likewise the Thunder defined to be a *Sound in a Clowd made by the extinction of Fire*, is a

And thunder.

definition consisting of all three. But this Thunder is onely defined by the subiect and the *Genus*, if we say, that *Thunder is a Sound in a Cloud*, and by the cause alone when we say It is *an extinction of the fire*. Now if the Nature of Accidents be such, and so great varietie be in their definitions, there is no reason but that a sound may be described sometimes one way and sometimes another, to wit, either perfectly or imperfectly.

One absolute definition of one accident.

Againe, what hindreth that one and the same thing may not sometimes bee defined absolutely, sometime relatiuely, the nature of it being as it were changed vnder the same name or appellation, as it happeneth to a sound heere. It remaineth therefore that there is but one definition of one thing, but if there be more, there is but one perfect and absolute, or else they be all imperfect and defectiue.

Againe, one definition is conceiued or written absolutely, another relatiuely. Let it not then seeme strange to any man that one and the same thing according to a diuers acception thereof, is by *Aristotle* diuersly defined; as also in the first Booke *de anima* hee defines *anger* to be an appetite of reuenge, and presently after; that it is a Feruour or boyling of the blood about the heart.

Againe, hee describes a house to bee a couer and shelter to defend vs from the violence of windes and showres, and also hee defines it to be a worke or building made of Clay, stone and wood: euen so heere when he describes a sound to be a percussion of one body against another, it is not *formally* defined but by the efficient cause: so wee say the Eclipse is an interposition of the earth, that is, caused by the interposition of the Earth.

Others defining a Sound say it is a passiue quality striking the Sense of Hearing. But we haue added a third (saith *Placentinus*) which notwithstanding I will not Discourse of so fully as he hath done, because many things will fall into the following Controuersies.

QVEST. XL. *Of the differences of Sounds.*

The diffrence of a Sounde from the Essence.

WEe are to know when we treate of any subiect, first what it is, and then how manifold it is, wherefore hauing set downe the true definition of a Sounde, we will now speake of the differences thereof, which differences bececause they be drawne from diuers Fountaines and Originals, they are therefore as diuers and manifold.

Graue.

First in respect of their essence they are thus distinguished: Some Soundes continue long, others endure but a while. Both of these may be thus subdiuided: the first dooth either by his long continuance much mooue the Sense, or else but a little; and this is called a graue, base or an obtuse sound. But that which is of a smal continuance is diuided into that which either in this short continuance doth greatly mooue the Sense, or in the same time doth mooue it verie little, and this is called an acute or trebble sound, & it is

Acute.

opposite to a graue or base Sound. And both these haue borrowed their Names from tactile qualities which do properly challenge these names to themselues. An acute sound hath his name from a sharpe or acute heate or cold; for as these qualities do easily penetrate any body, so this the Sense, which in a short time causeth much Sensation. An obtuse sound hath his name from obtuse or dull heate and cold, because it dooth much resemble them.

Obtuse.

And by these may be gathered a manifest difference betwixt a Sound and the obiects of other Senses, for they all doe remaine in the sensible things when the Sensation is past, in which things they actually exist both before and after Sensation, but the Sound doeth va-

vaniſh and goe to nothing, together with the perception thereof. And hence it was that *Ariſtotle* ſayd *ſome ſounding things were onely in* potentia *or in power, and others in Act, &c.*

Againe in reſpect of the Eſſence ſome Sounds are Direct, others Reflected which is called an Eccho. The Eccho.

According to their exiſtence ſome Sounds be in power and poſſibility, others in act. The formall and inheſiue ſubiect of potential Sounds is the Aire and Water, but the ſubiect of an actuall Sound is Iron, Braſſe, Siluer, Gold, Stones, VVood and other hard and ſmooth bodies. And hence doth ariſe another eſpeciall difference betwixt a Sound and the obiects of other Senſes, for theſe doe inhere in the ſenſible thinges actually and ſubiectiuely, both before, in, and after Senſation: but a Sound doth not exiſt in any ſenſible thing actually and ſubiectiuely, neither before nor after, nor yet in the very perception of the ſame. Different ſounds from the eſſence.

Againe, in reſpect of the manner of their production. Some Soundes are made by the fraction of the ayre cauſed by two ſolide bodies, and theſe bodies becauſe they concurre vnto the making of a Sound, being diſtinct either indeed or in ſome reſpect; according to their diuers and manifoulde concurſion this kinde of Sound is againe diſtinguiſhed. Manner of production.

Some are made by alliſion, as when the ayre moued by a vehement winde doth beate againſt a ſolide body, and of this kinde is the ſound when the Lungs doe deliuer ouer the ayre or breath vnto the hard parts of the rough artery which maketh a kinde of wheezing or whiſtling. There ariſeth alſo another kinde of Sound when the ayre beateth againſt other ayre, as it is when the winde is high, for at ſuch time in the open fieldes a man ſhall heare a whiſtling noyſe. The ſound of winde.

There is another kinde of Sound riſing from coition, coition I meane or coniunction of the ayre as when cloath or paper is torne, for then to auoyde vacuity the partes of the ayre do ſodainly conioyne at the ſides of the cloth or paper, where the firſt parts that are driuen are broken by thoſe which follow and ſo make a ſound. Of cloath.

There is another kinde of Sound made by extention of the ayre, as when in hiſsing it is driuen thorough the teeth. Finally, another by conſtriction as in a pipe or a payre of bellowes, or in holes or caues of the earth whereinto the winde driueth the ayre, and when it is in, ſhouldreth it as it were into a corner. Hiſsing.

The differences of Sound in reſpect of the reſonant bodies are double according to the difference of thoſe bodies, to wit, one Naturall the other Violent. I call that Naturall which is made by ſuch bodies as are able from a principle within themſelues to make an impreſsion, or to giue a ſtroke. And this Sound is againe double, the firſt belongeth to animated bodies, the ſecond to thoſe that haue no life. That of animated bodies is a ſound produced willingly by the mouing faculty of the Soule. And it is againe double, that is, made by ſuch organs as are by Narure principally deputed for the production of ſounds, or by ſuch organs as are not to that end appointed. The firſt kinde is yet again double, One formed by the *Glottis* of exſpirated aire and is called a *voyce*, the other is made of aire which is not receyued by Reſpiration, nor formed by the *Glottis*, but by the action of ſom other body. And of this kinde is the ſound of thoſe creatures which we call *Inſecta* and of moſt Fiſhes. The Sound that proceedeth from ſuch organs as are not thereto by Nature deputed is alſo double. Firſt, as when two creatures or two hands do ſtrike one againſt another; the ſecond when one body hath life the other hath none, as when a man ſtrikes his hand vpon a Table. Naturall ſounds. The voice. Violent ſounds.

Furthermore, the naturall Sound of bodies without life, is that which is made by the action of the firſt qualities, as that of the Fire, of the Aire, of the Water, of the Earth or of theſe mixed: for example, the thundering of Aire when it is concluded or ſhut vp in water and violently breaketh foorth through a narrow outlet. And thus much of Naturall Sounds. I call that Violent which is made by bodies beaten one againſt another by an extrinſecall or outward principle, all which might be nicely parted into ſeuerall Sections if we did not thinke that any man might out of the order we haue before inſiſted vppon frame vnto himſelfe a multitude of diſtinctions or differences of Sounds.

QVEST.

QVEST. XLI. *Of the manner of Hearing.*

Diuers opinions of hearing *Alcmæon.*

COncerning the manner of Hearing the Phyloſophers doe diuerſly diſſent in their opinions.

Alcmæon thought that we doe therefore Heare becauſe our Eares are empty and hollow within, for all empty things doe make a reſonance.

Diogenes.

Diogenes thought that there was a kind of Ayre within the Braine, and that this Ayre was ſtrucken with the voyce, & this conceit was controuerted in *Hippocrates* times, & therefore in his booke περὶ ἀέρων, he inueigheth againſt it; *There are* (ſaith he) *ſome which writing of the Nature of things haue affirmed that the braine doth make a ſound, which cannot be, for the Braine is humide and moyſt, but no moyſt body can cauſe a ſound.* *Plato* writeth that Hearing is made by the pulſation and beating of an internall Ayre.

Hippocrates.

Plato.

But we paſsing by theſe ſlippery wayes of opinions will inſiſt vpon the true manner of Hearing, and in a ſhort and familiar diſcourſe diſplay the whole Nature thereof. For becauſe the Organ of Hearing was vnknowne to the antient Phyloſophers and Phyſitions, particularly to *Ariſtotle* and *Galen* in whoſe dayes Anatomy was but in the infancie and therefore the many ſmall and curious parts of that Organ not found out; we cannot therefore collect the perfect nature of Hearing out of their writings, and therefore in this diſquiſition we muſt truſt more vnto our owne experience.

How hearing is made.

Ariſtotle in his ſecond booke *de anima* and in his booke *de ſenſu & ſenſi.* ſaith, that three things are required vnto ſenſe.

The obiect of it.

What ſound is

The obiect, *medium* and inſtrument or Organ, the obiect of the Hearing is Sound, as colour is the obiect of the light, but of the Nature of a ſound, wee haue intreated already as much as is neceſſary for this place. Onely I will call to your remembrance by the way, that a Sound is a quality ariſing from the fraction and breaking of the Ayre which is made by the percuſsion of two hard and ſolide bodyes, for ſoft things doe eaſily yeeld, neither doe they reſiſt the force of that which beates againſt them.

The *medium* of it.

The Organ of it.

The *medium* or meane of Hearing is the externall Ayre, for *Ariſtotle* doubted whether a voyce could be heard in the water or no, and yet he knows very well that Fiſhes do heare who was euer preſent at the fiſhing for Mullets in the night.

The inſtrumtnt of the Hearing is not the externa l Eare, but the internall, which conſiſteth of foure cauities and many other particles vnknowne to the Antients.

The manner of hearing.

The manner therefore of Hearing is thus. The externall Ayre beeing ſtrucken by two hard and ſolid bodyes, and affected with the qualitie of a ſound doth alter that Ayre which adioyneth next vnto it, and this Ayre mooueth the next to that, vntill by this continuation and ſucceſsiue motion it ariue at the Eare. For euen as if you caſt a ſtone into a pond there will circles bubble vp one ouertaking and mooving another: ſo it is in the percuſsion of the Ayre; there are as it were certaine circles generated, vntil by ſucceſsion they attaine vnto the Organ of Hearing. *Auicen* very wittily calleth this continuation of the ſtrucken Ayre *vndam vocalem, a vocall waue.*

But this kind of motion is not made in a moment but in ſucceſsion of Time, whereupon it is that the ſound is not preſently after the ſtroke, heard from afarre. The Ayre endowed with the quality of a ſound is through the auditory paſſage, which outwardly is alwayes open, firſt ſtriken againſt the moſt drie and ſounding membrane, which is therefore called *Tympanum* or the *Drumme.* The membrane being ſtrucken doth mooue the three little bones, and in a moment maketh impreſsion of the character of the ſound. This ſound is preſently receiued of the inbred Ayre, which it carryeth through the windowes of the ſtony ſtone before deſcribed, into the winding burroughs, and ſo into the Labyrinth, after into the Snaile-ſhell, and laſtly into the Auditory Nerue which conueyeth it thence vnto the common Senſe as vnto his Cenſor and Iudge. And this is the true manner of hearing.

QVEST

QVEST. XLII. *Whether the proper and inbred Ayre contayned within the Eare be the primary and principall Instrument of Hearing.*

THE proper and ingenit ayre which the Barbarians call *Implanted*, and *Aristotle inædificated* and *immoueable*, is contayned in the second cauity of the Eares, which the same *Aristotle* calleth the *Snayle-shell*. Some doe call it *Immoueable*, because it is not mooued by any other, but alwayes remaines the same in the Eares. Others call it *immoueable*, because it hath no naturall sound, but can receiue all the differences of Sounds. The auntients thought that this ayre was the chiefe and principall organ of Hearing, and in respect of this ayre *Aristotle* in his second booke *de Anima*, and in his booke *de Sensu et Sensil.* saith, the nature of the Hearing is ayrie. The names of it.

Indeede I esteeme this Ayre to be very necessary vnto Hearing, yea so necessary that Hearing can scarsly bee performed without it: but I can neuer perswade my selfe that it is the principall organ of Hearing. It is an vniuersall Theoreme and generally true, that in euery perfect organ there is some certaine particle to which as to the chiefe cause the Action is to be attributed; so in the Liuer the παρέγχυμα maketh Sanguification. In the Eye the Cristalline humor causeth Sight, in the Muscles, flesh effecteth motion and the Mamillary processes doe make the Smell. But it will be obiected, that this inbred ayre is not a Similar part, therefore no such Action is due to it. The inbred ayre is not the principall organ of Hearing.

Now that it is no part may be thus demonstrated. Euery Similar part is either Spermaticall or fleshie, but this ayre neither deriued his Originall from the seede nor from the blood; therefore it is no part. If it be answered, that it is not indeede a simple ayre but a kinde of spirit. I againe reply, that it cannot be a spirit; for if you conceiue it to be a vitall spirit, it should not forsake the Arteries. If you say it is Animall, then should it follow that an animall spirit should be accounted the chiefe Instrument in the organs of the other Senses. The inbred is no part.

Againe, a spirit is the most commmon organ of the Soule, which that noble forme vseth vnto the performance of all her functions. But as there is a peculiar part in the eye which doth primarily cause vision, to wit, the Cristaline humor; a Similar and Spermaticall part generated of the purest portion of the seede: so there must be such a Similar part found in the Eare. But such is not that ingenit or inbred ayre, because it differeth nothing from the outward ayre, but onely in purity and rest. It is generated of the outward ayre, not indeed by coction and elaboration, as are the spirits; nor yet by any action of the Soule, but by the continuall arriuall of new ayre, which partly is brought thorough the hole of the Eares, being alwayes open and winding, vnto this Cochlea or Snaile-shell; partly deriued thither, by inspiration thorough a certaine little hole or pipe like a *water-course* opening into the palate. How it is generated.

Moreouer, wee may out of *Aristotle* in the second booke *de Anima*, prooue that nothing without life can be the instrument of any Sense: but the inbred ayre is without life or soule, because the Soule is not an act of a simple body. Neither hath this inbred ayre any organs of a soule, for why should this ayre which is onely generated by the outward ayre, not concocted by any faculty of the Soule, be rather animated then that ayre which is in the other cauities of the body. But this ayre doth *rest* in the Eare, and not in other cauities; because it is concluded in a straite hole, and by reason of the windings of these darke laborinths cannot easily passe forth. It is not animated.

It is not therefore the organ of Hearing, but rather an internall *Medium*. For as the outward ayre is strucken by the beating of two bodies together, so is this internall strucken by the externall, & that by the interiection of the Tympane, or Drume, of the Chord or String, and of the three little bones. The same ayre being altered, doth carie the bare Character and *species* of the Sound seperated from the matter, to a nerue of the fift conjugation, led a long and dilated in each Eare. And this Nerue is the chiefe organ of Hearing, as the mammillary processes are of the Smell. It is an internall *Medium*.

Now that this internall *Medium* is required in euery Sense, may bee demonstrated by example, for the watery humor is the internall *Medium* of the Sight, the spittle of the Tast, the cuticle or scarfe-skin of the Touch, and the spongie bones of the Smell. In all which the formes are seperated from their matter, and being so seperated are conuayed to The internall meanes of all the Senses.

the principall ἀισθητήριον or Organ: that is the Christalline, for the Sight, the Pulpe of the Tongue for the Taste, the Mamillarie processes for the Smell, the true skin for the Touch, and so the Auditorie nerue for the Hearing.

QVEST. XLIII. *An explication of certaine hard Problemes about the Eares.*

Why Hearing is more delightfull then reading

IT remaineth that wee proceede vnto the dilucidation of some difficult questions concerning the Eares, which knots we will vntye and explane for a conclusion of these controuersies. The first thing propounded is, How it comes to passe that *wee are more recreated with Hearing then with Reading*: For we are wonderfully delighted in the hearing of fables and playes acted vpon a Stage, much more then if wee learned them out of written bookes. *Cardan* as *Scaliger* saith in his 308 *Exercitation*, contents himselfe with this onely reason, because, saith he, those things which are published in bookes are made vulgar and common, and therefore are not so curiously nor with so much delight read ouer; but good Actors are more rare.

Cardanus.

Disproued by *Scaliger.*

Scaliger refuteth this argument, both because good bookes are as rare as good Actors, as also because it is not the part of a humane ingenuous disposition but of a liuid and malicious minde, to esteeme those things most precious or more pleasant which are vnknowne to others.

His Reasons.

Scaliger therefore presenteth many other reasons of this Probleme. First, because we learne those things which we heare with lesse labour then those things which we reade.

Secondly, because a voyce doth more affect vs by reason of his inflexion and insinuation into our Sense, whereas reading is onely a dumbe Actor.

Thirdly, because those things which be heard, take a deeper impression in our minds, which is made by the appulsion or ariuall of a reall voyce. But those things which are seene are alwayes intentionally imprinted, & therfore the Act of Seeing is sooner ended and passeth more lightly by the Sense then the Act of Hearing. Whence it followes necessarily that things seene do not sticke so fast vnto vs. And this the Apostle insinuateth when he saith, *He beholdeth his face in a glasse and goeth away, and presently forgetteth what manner of one hee was.* Neither is that of the Lyrick Poet any sufficient contradiction of this where he saith:

Segnius irritant animos demissa per aures,
Quam quæ sunt oculis subiecta fidelibus.
The voyce that sinkes in by the eare doth not so soone offend
Or gall the minde; as when the eyes more faithfull message send.

For that is true of those things which we doe onely beleeue by heare-say, which indeed doe not so neerely affect vs as those things we see done before our eyes.

The fourth reason is, because there is a kinde of society in narration and acting, which is very agreeable to the nature of man, but reading is more solitary.

Fiftly, because a certaine shamefastnesse and obseruancie doth cause vs to apply our eares to him that vttereth any thing by voyce, but in reading there is a kinde of remission in the minde and security from any blame of not profiting. Now wee conceiue more pleasure in a diligent and curious acting, then in a negligent and careless.

Sixtly, wee haue opportunity to demaund a reason of some doubts from him which speaketh to vs; and thence we receiue more profit then by bare reading, from which profit a certaine delight doth arise. Againe, because Bookes cannot digresse from their discourse for the better explication of a thing, as those may which teach by their voyce. For in changing of words or mutuall conference, many pleasant passages are brought in by accident, as the Interlocuters list to aduance themselues; as we see in Comedies it is very ordinary. And by these sauces, as it were, of discourse, is the Hearing more sumptuously feasted, but the vniformity of the stile in things written and the continuity of the sentences causeth the Reader to loathe it.

The second question is, why a mans voyce which is sweeter then the sound of a Pipe, is yet not iudged sweeter by the Eare if a man imitate the sound of a Pipe with his voyce; for when a man sings his voyce is sweeter then a Pipe, but a Pipe is more pleasant then a mans voyce when he whistleth.

Some

Some resolue this probleme thus, that it so hapneth because that which is naturall is more pleasant then that which is counterfeited and fained. And therefore when a man sings he addeth an articulation to his voyce aboue the sound of the Pipe; wherefore it is not strange that it is iudged to be sweeter; but when he imitateth a pipe or whistleth, hee doth not so sound pleasantly as a pipe, because he doth counterfeit it.

The third question is why we do conceiue a song to be more pleasant in consort with a pipe then with a harpe. I answer, because both the sounds are heard distinctly by themselues and better mingled together, for both a mans voyce and the sound of a pipe are accomplished by a breath within, but the sound of a harpe is not so. Againe, it may be thus answered, because a pipe, whose sound is somewhat akin to the voyce, doth drowne many faults in the song, which the sound of a harpe doth not being fine & smal & vnfit to consort with the voyce but is heard distinctly by it selfe carrying his owne tune simple & pure & so discouers all the slips and errours of the song by his owne iust and proportionable harmony. Now seeing that in singing many things happen out of order that sound which doth most of all bewray the confusion that is betwixt harmony and discord must needs be more harsh in the Eare. 3. Question.

The fourth question shall be, why children when they heare musicke doe first ceasse their crying and after fall asleepe. *Alexander* in the 121. Probleme of the first booke, rendreth this reason of it: because there is a kinde of harmony in the soule by instinct, as other sciences be; neither doe we obtaine any thing by *doctrine* as *Plato* affirmeth, but onely by *recalling to mind*. As often therefore as the soule perceiueth any pleasant melody, she as it were, repeating and calling to mind her owne Nature, causeth the infant to ceasse crying, and luls it asleepe by drawing it selfe from the trouble of outward obiects. 4. Question.

These are the Platonists arguments.

But *Aristotle* more truely resolueth this probleme in the 39. probleme and 19. section where he demandeth *why all men are wont to be delighted with numbers, tunes and all kindes of musique. Is it because euery thing according to Nature is done by number and measure, that so it might tickle and delight our Senses or our minds?* Surely a great argument of the exact and curious disposition of Nature we may finde in our selues, for when we labour, drinke & eate ordinately, that is, according to our proportion (the scantling whereof is most commonly taken by experience) wee doe not onely conserue the naturall disposition and frame of our bodyes, but also increase our strength and perpetuate the vigour both of body and minde: on the contrary, when when we liue dissolutely, that is, inordinately all things succeed and runne headlong into detriment. In like manner the resonance or consonance which we speake of, is, nothing else but an ordinate or propottionable mixtion or temper of contraryes amongst themselues; which contraryes if they keepe quarter and make, as it were, faire warre, there is a kinde of military order or consent in disagreeing. *Aristotle* therefore conceiueth that the consent of words doth therfore refresh, please and delight the Eares, because it is compounded according to certaine lawes deriued or taken from the nature of the thing. Neither is this onely true in the Sense of Hearing, but also in the obiects of the other Senses, for in a picture onely those colours doe delight the Eyes, and in a feast those sapours the Tast, wh ch are tempered after a certaine maner and proportio). *Aristotle* addeth further, that not onely Musicall sounds, such I meane as are made according to art, but those which they call *modi adiectiij*, that is, extrauagants, such as wee call the *blacke*, *Santa* doe oft times delight vs, especially if we be accustomed vnto them. The reason is because custome is another Nature. Wherefore that which is by custome made proportionable is as wel musicall as that which is naturally melodious. *Aristotle.* Example in our selues.

A fifth question may be why he that singeth the *Base* is sooner discouered if he make any iarre then he that singeth the *Trebie*: the like happeneth in numbers, for in that which is greater, the error is more euident; but let vs giue the reason. VVe say therefore, it is because the base sound consumeth more time, and by that meanes is better perceiued by the Eares; but the Treble sound is swift and doth easily and suddainly passe away. 5. Probleme.

A sixth question is, why we doe not heare well when wee yawne. I answer, that in the act of yawning, (which the Latines call Oscitation) wee shake out and disquiet a dull and sluggish winde which lurketh in the cranies and chinkes of the throate, which winde attaining vnto the Eares by those perforations which are made from them into the palate stoppeth and fulfilleth the Organ of Hearing, and withall causeth a kinde of disturbing noyse which darkeneth the brightnesse or dulleth the edge, or adulterates the puritie 6. Probleme. Why yawning hinders our hearing.

which commeth from without: ſo alſo we ſee, that if two men talke together & at once, they cannot heare one another, at leaſt not diſtinctly, becauſe the Sounde of eithers voice is repelled by the other, and that is the reaſon that he that would liſten & heare diſtinctly holdeth his breath.

Add heereto, that the holes of the Eares are compreſſed when the *mandibles* or iawes are diſtracted or drawne aſunder by oſcitation or yawning. If then the hole of hearing be compreſſed, the aire which carrieth the Sound cannot ſo freely arriue vnto it.

7. Probleme. The ſeauenth queſtion is, why if a man be within a houſe he will ſooner heare a noyſe that is made without: and on the contrary he that is without the houſe ſhall not perceiue a Sound made within the houſe? The Reaſon is thus rendred, He that is without dooth not ſo well perceiue the ſound that is made within the houſe, becauſe the aire breaking foorth is diſsipated or diuided in a greater roomth or more capacious place and ſo the ſound becommeth dull and looſeth his vigour being parted with the aire into ſo manie parts, or ſtretched into ſo wide an extent. Againe on the contrary, he that is within the houſe doth eaſily heare a noiſe that is made without, becauſe the ſound entering into the houſe is contracted, gathered or vnited, and therefore it muſt needes mooue the Senſe more fully. The very ſame reaſon ſeemeth to bee in the acte of Sight, for beeing within doores we ſee better that which is done without, then if we were without doores we ſhold diſcerne what is done within, for the ſpecies comming from without into the houſe are gathered and vnited. Againe, the viſiue vertue of the eye within the houſe which vndertaketh to view that which is without is eaſily diſsipated or diſvnited.

8. Probleme A pretie queſtion. *Ariſtotle.* The eight and laſt queſtion ſhall bee, whether when manie men talke together they can be heard further then if one man onely ſpake, imagining the voyces to be equall. This queſtion made *Ariſtotle* at a ſtand, yet hee reſolueth it thus in the ſecond probleme of the 19 Section. It is (ſaith hee) becauſe it is more eaſie to worke with vnited powers then with ſingle and ſeparate, for all compound thinges are of greater force then Singulares. VVherefore when many mens voices go together, the Sound muſt needs be conſtant and vnited, and ſo driue the aire much farther then otherwiſe it would bee driuen by a ſingle Voice in the ſame Key.

Experience. To *Ariſtotle* we adde Experience and Example. Experience, becauſe you may heare the tumult of an Armie further then the vociferation or crie of one Souldiour.

Examples. Againe, in Markets and Fayres where many people are aſſembled, the murmur of the multitude is heard further then the voice of one man though he be lowder then his Fellowes. The noiſe of a Frogge is not great Iwis, yet what time they breede they may bee heard many miles out of the Iſle of *Elie*. Neither are we to wonder at this, for wee haue examples of the like in the obiects of other Senſes, as many Candles of an equall bignes wil enlighten the aire further then one Candle though it be bigger then any of the other. A heap of ſand may be ſeen a great way off on the Seaſhore, but a moat of ſand can ſcarſly be diſcerned vnder the eye. If therefore it be ſo in the viſible obiect, why ſhould we not acknowledge it in the audible? For although the ſpecies of particular voices are not vnited, yet where there is a totall aggregation or heaping vp of many ſpecies together, they may produce one that a may attaine to a further limit then any of them could doe in particular.

Ariſtotle contradicteth himſelfe. I knowe well that *Ariſtotle* in another place, that is to ſay the 52 Probleme of the 11 Section ſeemeth to contradict that we haue before alledged out of him, which was the reaſon that I ſaide before *Ariſtocle* was doubtfull in the reſolution of this queſtion, but becauſe that which we haue quoted is the laſt, and after-thoughts (they ſay) are the Wiſeſt, we will reſt our ſelues therein: for if we ſhould take occaſion to diſpute with *Ariſtotle* too and fro alwayes when we haue occaſion offered, we ſhould wearie our ſelues, and forget that our Philoſophie is not of the maine, but by the Bye. Wherefore wee returne againe to our Anatomie.

QVEST. XLIIII. *Of the wonderfull ſimpathy and Conſent of the Eares, the Palate, the Tongue, and the Throttle.*

The ſimpathy of the Ears & inſtruments of the voice. THere be many things which do manifeſt this wonderfull κοινωνίαν or communion of the eares with the inſtruments of the Voice, which that *Genius* of Nature *Ariſtotle* in the 32. Section of his Problemes hath declared. For when wee would heare any thing attentiuely we hold our breath, when wee yawne we do not

not heare so exquisitely. And if you goade the Tympane of the eare with a Pen-knife it will presently cause a drie Cough. Those which be halfe deafe do speak but stutteringly and their voyce is made through their Nose. Againe, those who from their Birth are deafe, are in like manner ἄφωνοι, that is, are dumbe.

Lastly, if you holde an Instrument in your mouth or betwixt your teeth and stop your eares, you shall heare more perfectly; whence it is that deafe men do heare best by their mouths. All these are certaine and plaine arguments of that communion and sympathy which is betwixt the eares and the vocall instruments, to witte, the Mouth, the Tongue, and the Throttle. Whence this cõmunion is.

But the reason of this communion is not knowne to all. Some thinke, that the Auditory nerue, or the Nerue of the fifte Coniugation and that of the seauenth which mooueth the Tongue are couered with the same coate from their beginning, and therfore the affects of those parts are easily communicated. But ocular inspection doth perswade the contrary, for the passages and wayes of either coniugation are diuers, and there is a great distance betweene them. VVe (saith *Laurentius*) will acknowledge a double cause of this communion, the one is referred vnto the auditory Nerue, the other vnto a little Canale or pipe which was vnknowne to the Ancients.

The Nerue of the first Coniugation brancheth out into many surcles, the larger is dilated into the Eare and the Membrane of most exquisite Sense, and carrieth the species or formes of all Sounds vnto the Braine; the lesser runnes vnto the Tongue and the Throttle. The affects therefore of the Eares and the Tongue are easily communicated by reason of the communion of the vessels, which according to *Hippocrates* and *Galen* is the onely cause of this sympathy. Hence it is that the Membrane of the eare being prouoked or goaded doth cause a drie cough, whereof *Auicen* maketh mention. Hence also it is, that almost all deafe men be dumbe, or at least haue but an imperfect speech, the auditorie Nerue being affected, which is complicated or folded with the seuenth coniugation. For I do not approoue of that common position, that deafe men be therefore dumbe because they can learne no Language, and because Hearing is the Sense of knowledge. For if they were onely dumbe for this cause, wherefore should they then sigh & mourne with so great difficultie which are Naturall passions? VVhy shoulde they not; as well as those which were the first inuenters of things, faigne Language and words whereby they might expresse the thoughts and Discourse of their mindes if they could vtter them? For Nature hath armed a Man although hee bee deafe with Reason and Vnderstanding for Inuention. A double cause of this communion. *Hippocrates* his community of vessels.

It remaineth that wee proceede vnto the second cause of this consent which is by a gristly Canale like a water-pipe which is conueighed from the second hole of the Eare vnto the Mouth & Pallate. This course or pipe was appointed for the purging of the in-bred aire, for the auoyding of the excrements of the eares, as also that the in-bred ayre might bee recreated by the arriuall of new aire inspired by the mouth; and lastly, that by this way a passage may bee open for the externall aire rushing forcibly through the hole of the Eares, as it is in the noyse made by Ordinance when wee are neere it. The Ayre therefore doth passe freelie out of the mouth into the Eare, and againe retireth from the Eare into the mouth. VVhence it is, that when wee would heare more attentiuelie wee holde our Breath, least the *Cochlea* or Snaile-shell should bee filled with aboundance of inspired Aire and so the Tympane bee stretched. But such as yawne doe not heare so well, because in this yawning or gaping the Tympane is so stretched and puffed vp, that it cannot receyue outward Sounds. The second cause of the sympathy. Reasons of the former instances.

Lastly, by scratching the Eare wee prouoke Spittle, because by that compressing there is an expression of Excrements into the Cartilagineous or gristlie passage, and so from thence vnto the Tongue. And thus much of the Sense of Hearing, now we come vnto the Smell.

QVEST. XLV. *What Smelling is,*

The diſſiniti- of ſmelling.

THat the Noſe was by Nature made as well for Reſpiration as for the Senſe of Smelling, we haue beſore declared. But what is the Senſe of Smelling, that we doe vndertake in this place more preciſely to vnfould. *Smelling therfore is the middle Senſe of fiue, which perceiueth the odours of thinges drawne in by the Noſthrils for the vſe and behoofe of the Creature.*

It is a great queſtion (which alſo we haue a little touched before) whether to the action of this Senſe the Inſpiration of aire together with the odour be of abſolute neceſsity; and yet the ſtreame and current of mens opinions as well Philoſophers as Phyſitians run vpon the affirmatiue part. For if we deſire or bee willing to endeuour our ſelues to Smell any thing more curiouſly, we draw the ayre in at our Noſtrilles, and that is the reaſon why we cannot ſmell in the water, becauſe the water that is drawne filleth the paſſages of the Organ. *Placentinus* is of the contrary opinion and alledgeth *Ariſtotle* for his authour in the fift Chapter of his Booke *de Senſi & ſenſil.* where he ſayth that Nature doth but collaterally vſe Reſpiration in the Attraction of odours, which Reſpiration, ſayth he, ſhe deſtinated primarily to another end.

Whether inſpiration be neceſſary to ſmelling.

If therefore Reſpiration be neceſſary to the Smell, then it followeth that Nature ordayned it primarily for that end. For, ſayth he, this is a rule in Nature, that whatſoeuer in our bodies doeth neceſſarily belong to any function that is primarily appoynted for that function, and doth not ſort vnto it by error, chance or accident.

Seeing therefore the primary and chiefe vſe of Reſpiration is to refreſh and cheriſh the heart and his ſpirites, it followeth that it is not altogether neceſſary for Smelling.

Indeede one and the ſame thing may haue diuers vſes, but the principall and primary vſe is but one, for which onely it is neceſſary, and to the reſt accommodated onely ſecondarily or by accident Againe, if an odour of it ſelfe be fit to aſcend vnto his own Organ why ſhould we thinke that Reſpiration ſhould be ſo abſolutely neceſſary. Now an odour is nothing elſe but a *hot and dry exhalation* as we ſhall proue afterwards and exhalation, of their owne Nature doe tend or moue vpward. If then they aſcend naturally, why may it not be that a ſweet and pleaſing breath may riſe into the Noſtrilles and paſſe on vnto the Organ of ſmelling without any attraction of the ayre.

Fits of the mother are holpen by ſmels.

Placentinus addeth another argument which hee calleth Inuincible, taken from thoſe women that are Hyſtericall, that is, haue fits of the *Mother*. For ſuch woemen although they haue no Reſpiration at all, doe yet receiue and perceiue odours, and not onely ſo but are almoſt miraculouſly redeemed or recouered by them: what ſhall wee ſay vnto the wombe it ſelfe, doth it not ſmell? yet no man did euer ſay that the wombe did reſpire, yet dayly experience teacheth vs that it taketh ſo great pleaſure in ſweete Smels and is ſo offended with that which is noyſome and abhominable, that it mooueth and applyeth it ſelfe manifeſtly vnto the one and auoydeth the other, euen with Locall and Methematicall motion.

The wombe followes ſweet ſauours.

Obiection.

But it may be obiected that if we hold our breath we cannot ſmell, and therefore this Senſe is not accompliſhed without Inſpiration. *Placentinus* anſwereth that it is not true, that if an odour be applyed to the Noſe and the breath retayned no Senſe will bee made; and thoſe who vrge experience are deceiued in their experimenting. For the breath cannot bee ſo retayned that nothing at all ſhould either get in or out. If then any thing enter in it helpeth the attraction of the odour: if any thing get out it hindreth the ſame, yea it repelleth or driueth it from the Organ. And that the breath cannot be ſo immouably retayned, may be conuinced by reaſon and experience.

Solution.

Reaſon ſayth that becauſe ſuch retention of the breath is violent and againſt nature, Nature will likewiſe with all his force and vigour reſiſt and oppoſe that violence, and beſide that, all the Organs of Reſpiration doe by a proper inſtinct haſten to their Naturall Action.

Hence it followeth that the Muſcles ſtaggering as it were in their worke of ſuſtentation, and the Lungs declining downeward, by their waight doe betwixt them perpetually expell ſome ſmall quantity of ayre, which is a ſubtle and fluide Element, and wil finde way through inſenſible paſſages. Now that there is ſuch an inſtinct in the muſcles ſeruing to Reſpiration, & that this inſtinct may doe much we may eaſily coniecture, becauſe though a muſcle is otherwiſe an inſtrument of voluntary motion; yet euen in ſleepe when all e-

lection

lection is absent, and the will especially vnto motion is at rest as well as the body; yet euen then the intercostall muscles, and the midriffe which serue for Respiration doe follow the necessity of Nature, and moone as freely as when we are awake. Shall wee therefore conceiue that vpon the same necessity or a greater, when wee our selues doe voluntarily seeke to oppose and frustate the end of Nature, shee shall not bee able without our knowledge and against our wills to let out so small a quantity of Ayre as may suffice for this her purpose, of Ayre I say, which is so subtle & fluid a body that it will issue at the least crannie and yeeld vnto the least impulsion or violence.

Experience confirmeth the same thing for if you burne any thing that is odoriferous vnder the Nose and retaine your breath, you shall finde, nay you shall see that that fume will be mooued on this side and on that side, which no doubt commeth to passe by reason of the Ayre which passeth and repasseth outward and inward: but if it get within the nosthrils then it doth presently smell as any man that list to try may perceiue in himselfe. Indeed some men of no smal estimation haue affirmed that we cannot smell if we retain our breath, but the true reason is, because the odour doth not attaine vnto the Organ, nay it doth not enter into the nosthrils, for therein they are deceiued. They thinke they canne hold their breath immooueable, whereas indeede the naturall instinct driuing their breath foorth, doth also driue the odorable obiect from the Organ, but let them proue that though a fume doe of it own accord ascend into the cauities of the nosthrils, yet it is not perceiued by the Sense of smelling vnlesse they adde respiration thereto, and then I will yeeld them the bucklers.

You will demand if Respiration be not necessary, why doe we purposely draw our breath when we would smell. Question.

The answer is at hand, to wit, that the obiect may sooner and more plentifully attaine vnto the Organ. VVe grant therefore that Inspiration helpeth the Smell much, but it doth not thence follow that it is necessary. Againe, to the maintenance of life Inspiration is absolutely necessary, but for *better life*, not so, but onely by accident or secondarily. In like manner we confesse that the Sense of smelling is not ordinarily without Respiration but yet it may be; and Respiration is not necessary to the being, but to the better beeing of the Sense. And if nature had prepared the way of Respiration through some other member, and not through the Nose; yet vndoubtedly the Nose would haue smelt, as we may see in those creatures, which do not respire. And this is *Placentinus* his opinion. Answer. The conclusion.

QVEST. XLVI. *Why Man doth not Smell so well as many other Creatures.*

PLato in *Timæo*, and *Theophrastus* in the sixth chapter of his sixth book *de causis plantarum* together with many other who haue written of this subiect, all of them, I say, with one consent doe acknowledge that the Sense of Smelling is more dull in men then in many other Creatures.

The same doth *Aristotle* auouch in the fourth chapter of his booke *de sensu & sensili*, where hee also addeth that of all the senses this Sense of Smelling in man is most sluggish and dull, which also he confirmeth in the 92. text of his 2. book *de Anima*. What creatures smell better then men.

The truth of this opinion is very euident by the example of other creatures as Dogges, Hogs, Crowes, Bees and other birds and beasts which are able a farre off to *wind*, as wee say, the sent of any thing. But man is constrayned to moue the obiect euen vnto the Nose and yet he is not able to discerne or perceiue any smels but those, that are so strong that they alter the Sense either into pleasure or paine. Add hereto, that many brute beastes doe know more by their smels then man can attaine to by all his senses, as the Hound that hunts vpon the cold foote of a Hare or a Deare, yea they can in the night follow a mans steps and worke out his way through a thousand difficulties and intanglements or permixtion of other Smels. So we see also that in the darke a Dogge would know his owne master from a great many other men onely by his smell. A Tyger being robbed of her whelps would finde them out againe by her smell. Now none of these odours can the Sense of smelling in man apprehend. Beasts smell many things that men cannot.

The reason hereof *Aristotle* in the place before quoted referreth vnto the fault, not of the faculty, but of the Organ. For this Organ is cold and very moyst, but the obiect hot and dry: now it is necessary that the Organ should potentialle bee such as the subiect is actually. So that when sensation is made the obiect may worke vpon the instrument and con- The reason of it.

uert

uert it into his Nature. But in this Sense of Smelling such conuersion cannot be made without great difficulty, for that which is moyst doth hardly become dry, and by reason of this difficulty a man smelleth but remisly or dully, that is, not without either pleasure or paine. The reason is, because the Obiect must be very vehement before it can turne the moysture of the Organ into his owne Nature, that is, make it hot and dry.

Other reasons. Beside, this proper & natiue vnfitnesse of the Organ, there is also another ineptitude added, and that is the vicinity or neighbourhoode of the braine, which is in man much greater in respect of his magnitude then in other creatures. Seeing therefore the braine aboundeth with moisture, which moisture is also imparted vnto the Instrument of Smelling, it commeth to passe that that Instrument by this coniunction of the braine becommeth more vnapt. Whence it is that the same *Aristotle* in the 33. Probleme of the tenth Section, hath obserued that the Instrument of Smelling is much incommodated by the moyst superfluities of the braine. The power therefore of Smelling being as it were steeped in this moisture groweth dull and sleepy, which in that which is hote and dry would bee awaked and shew it selfe; and therefore in bruite beasts whose braines are not either so moist, or at least yield not so much moisture because they are lesse, this Faculty or Sense is more pregnant and apprehensiue.

Obiection. Some arguments are neuertheless made to the contrary, for thus they say: Where the forme is more excellent, there also the faculty is proportionably excellent. Now wee know that the forme of a man which is his Reasonable soule, is farre more excellent then the Sensatiue forme of a bruite beast, wherefore the faculties also of his forme are more perfect, and among the rest that of Smelling.

Solution. We answere, that albeit the Soule of a man is much more excellent and diuine then the Soule of a beast, yet so long as it is chained in the prison of this body of Earth, it cannot performe his functions but by the helpe of corporeall Organs, and therefore as the Temperature and conformation of the Organs is more or lesse conuenient, so are the functions more perfect or imperfect. Seeing therefore that the Organ of Smelling by which as by a hand the Soule reacheth odours vnto it selfe, is as we said in men somewhat to moyst, and therefore vnfit for the sodaine and quicke reception of odours: it followeth that by reason of this fault of the Instrument the faculty of the Soule is as it were abated or allayed that it cannot so perfectly and freely manifest it selfe.

Obiection. It may be obiected againe, that because the Organ of a mans Smell is colde & moyst, hee should Smell the better not more dully, for that which is hote and dry as odours are, doth worke more powerfully vpon that which is the coldest and the moystest.

Solution. True it is, that the odour will worke better vpon the Organ, but as I said before, cannot so easily conuert it into his owne Nature, for the qualities of the Organ are in a great degree contrary & repugnāt to the nature of the Obiect, but when sensation is made they must grow to be alike. Wherefore if the Organ be so disposed that there is not so great a difference betwixt it & the nature of his obiect, it cōmeth to passe that they consent better together, and the Organ yeeldeth more easily toward the Nature of that which doth importune it: But we proceede vnto the Nature of an Odour.

QVEST. XLVII. *Of the Essence of an Odour.*

Heraclitus opinion of Odours. HEraclitus, as *Aristotle* remembreth in the fift Chapter of his Booke *de Sensu et Sensili*, conceiuing that Odours are a fumide exhalation, sayeth, that if all *Beings* had beene fumide the Nose would haue discerned of all.

Refuted by *Aristotle*. *Aristotle* replies vpon him on this manner. If that were true which *Heraclitus* collecteth, it would follow that those creatures which liue in the water do not Smell, for in the water there can be no fumide or smoaky exhalation generated. But that Fishes doe smell may bee proued by the choise of their meate, which *Aristotle* perswades himselfe they make by Smelling.

We, saith *Placentinus*, haue other Reasons against this opinion: First, because a fumide exhalation is a substance, for it subsisteth by it selfe and sustaineth accidents, and therefore naturally and by his owne motion we perceiue that it mounteth vpward. Now then if an Odour were a fumide exhalation, it could not be by it ffelfe sensible, for no substance doth by it selfe fall vnder any Sense. Yet no man will denie but that an Odour doth by it selfe and immediately worke vpon the Organ of Smelling.

Placentinus refutation of *Heraclitus*. It is true indeede that a fumide exhalation attayning to the nosethrils mooues the Sense of Smelling, but it doth not follow that therefore such an exhalation is an odour: rather wee should say that the Odour hath his subsistence in the exhalation as in her subiect,

iect: for accidents neither are, nor can be without their subiects.

Notwithstanding there is a place in *Galen* neare the end of the second chapter of his booke *de odoratus organo* which seemeth to prooue this opinion of *Heraclitus* to bee true; the words are these; *That falleth into the Sense of smelling which is betwixt the Nature of ayre and water, to wit, such a thing as is neither so thin as ayre nor so thicke as water, for that which exhaleth or vapoureth from the bodies of things is the substance of odours, which wee may perceiue by roses and the like tender plants whose bodyes doe quickely become lesse crumple, and dry vpwhence we may certainely gather that the more humide part of their substance is resolued in toexhalation.* Thus farre *Galen.* A place of *Galen* expounded.

We answer that *Galen* saith that the substance of an odour is an exhalation, by substance there meaning the subiect wherein the odour doth consist, for it had beene a grosse thing in *Galen*, and vnworthy the edge of so keene a Phylosopher, if hee had attributed substance to an odour which hath no existence of it selfe. And answered

And if any man shall insist vpon the example of Roses, we will giue him this satisfaction, that *Galen* doth not conclude that Roses therefore doe become lesser and dryer, because their moysteſt parts are exhaled into odours, but he saith that their moyster part turneth into an exhalation: and he saith true, for an exhalation which is a substance abstameth the humiditie of the body out of which it issueth, and diminisheth the same; for how can it be but diminished when a substantiall part is taken from the whole. But an odour is not a substantial part, neither is it made of a part, but subsisteth in the whole subiect, and is nothing else but *an accident or an incorporeall qualitie.* So that out of these words of *Galen* wee may gather this excellent point of learning. That where he saith, *That which exhaleth from the bodyes of things is the substance of an odour*, hee doth wisely signifie the *matter* out of which the odour doth arise which is the body, and the *subiect* wherein it doth inhere which is the exhalation; whereas therefore he saith that the exhalation is the substance of the odour, he doth not meane that the odour is a substance, but being an accident that it doth subsist in this substane as in his subiect.

But for the confirmation of this opinion of *Heraclitus* there are some obiections made to prooue that the odour it selfe is a fumide substance, because it performeth many things which cannot be done, but onely by a substance. And first, a creature may thereby bee nourished, for which they alledge *Plinie* in the 2. chapter of his seuenth booke where hee saith, that in the Easterne India about the fountaine or head of the Riuer Ganges, there is a nation without mouths, whom he calleth *Astomy* hairie, all ouer ther bodyes and cloathed with the leaues of trees. They liue of nothing but exhalations and odours which they draw in through their Noses; meate they haue none nor drinke: onely they vse to smell vpon certaine rootes and flowers and wilde Apples which they carry with them when they trauell farre, that they might not want something to smell to. These men are easily stifled with a strong odour. A story out of *Plinie.* The Astomy.

The like we reade of *Democritus* who they say sustained his life foure dayes with the smell of honey or hot bread. VVe answer with *Aristotle* in the fifth chapter of his book *de sensu & sensili*, where he ascriberh this opinion to the *Pythagorians* that such strange reports are mere fables vnworthy the credite of a hystory, because they abhor so much from reason. For those things which do nourish must be conuerted into the substance of the liuing body. Now that which is incorporeall cannot possible be conuerted into a corporeall substance; wherefore odour being of it selfe an incorporeall accident and therefore not changed into the substance of the creature cānot become a nourisſment therto. Beside all creatures haue some place in their bellies which receiueth their meate, and from whence the body draweth that which sustaineth it. But the Organ of odours is seated in the head from whence no member of the creature seeketh for nourishment. *Democritus.* Reasons against *Plinie.*

They vrge further the example Cookes, who because they are busie in boyling and roasting viands for other men, doe receiue so many odours from them that they scarse euer are a hungry or desire meate, but rather being satisfied with the smell doe loath the substance, and therefore it is commonly thought that these smels doe satisfie and cloy thē. But we deny that this commeth to passe by reason of the odours of meates, but the reason why they desire not meate as other men, is, either because as it is in the prouerbe, they can licke their owne fingers, that is, tasting a little of euery thing they insensibly fill their stomackes, or being alwayes about the fire their pores are opened and the inward heate dissipated which is wont to mooue and solicite the appetite, which also is the reason why euery Why Cookes haue no good stomackes.

ry man in winter eats more then he doth in Summer; Or we may say, that they are dried by the heate of the Fire and so become thirsty and drinke often, insomuch that the stomacke being relaxed or loosened by the moysture of drinke becomes languide and so the appetite is broken: or we may say further, that being very dry they cannot be hungry, because *Aristotle* sayeth it is impossible that at one and the same time a man shoulde vehemently desire both meat and drinke.

Obiection. It is further obiected that as *Aristotle* sayth in the fift Chapter of his Booke *de Sens. & Sensi*, which also is prooued true by experience, that when we are full wee loath the Smell of meates, but delight in the smels of Spices and Roses. If therefore the odour of meate did not nourish, a full stomacke would no more abhorre the odours of meate then of Roses or Spices.

Solution. But we answere that this saciety hapneth not because of the odours, but because of the steame or exhalation wherein the odour is; for wee grant that such a steame may in some sort nourish: but the odour of Roses which hath for his subiect a more subtle exhalation is better pleasing vnto vs, especially because their smell is very fragrant and acceptable, whereas the Smell of meates is neuer pleasing but when wee are an hungry. VVee conclude therefore with *Aristotle* in the place before quoted. That odours doe not at all nourish. Others disputing more probably doe make according to *Galen* two kindes of nourishments; one which is taken by the mouth and nourisheth the solide partes of the body; another which is drawne through the Nosthrils which nourisheth the thin & ayry parts, as the spirites, for *Galen* affirmeth that the spirites doe feede vppon ayre and odors.

Some say that odours nourish the spirits

Their reasos. VVherefore the nourishment of the spirits they attribute vnto odours, and the rather are they induced so to think because nasty and abhominable smelles doe make men oftentimes swound, yea and such exhalations arising from dead Carkasses or muddy fens doe infect the ayre and breede a pestilence. Adde hereto that in the Low Countries the odour that ariseth from the flowers of beanes as they grow in the fieldes, doe often driue trauellers into a deliration or light madnesses as *Leuinus Lemnius* hath obserued. And *Plutarch* sayeth that by the smell of oyntments Cats doe grow mad. Moreouer, Physitians doe consent that the smell of spices doeth breede καρηβαρίαν, that is, a payne or dull stupidity and fulnesse in the head.

Answere. Adde hereto that many odours or smels are able to refresh a man when he is ready to swound or faint away; they exhilerate or cheare the heart, and if we may beleeue *Aristotle* in the place before quoted, they correct the distemper of the brayne. All these thinges we confesse are true if they be vnderstoode of that vaporous or aerie exhalation or substance wherein the odour is transported, for by that meanes or in that respect onely the odour is sayde to nourish the spirites, and *Galen* in his 8. Booke *de compositione medicamentorum secundum locos* and the 4. chapter writeth, that if with the odours there are also many vapours associated, then, sayth he, such odours haue some faculty to nourish. But if we vnderstand by odours the simple obiect of the smell, naked and separated from exhalations it is vtterly false that they say; for although that vaporous substance wherein the odor is conuayed doe by the helpe of other qualities concommitating or accompanying the odours cherish and refresh the spirites and performe those other good offices which wee haue remembred, yet it followeth not from hence that an odour is a substance: rather that it is an accident of a substance, because it doth inhere in the forenamed qualified vapour. But we will come vnto the definition of an odour.

QVEST. XLVIII. *The definition of an Odour.*

What an odour is. *AN Odour is a quality mouing the smell arising out of a fit mixtion of the foure Elements wherein heate and moysture haue the predominance.* For wee conceiue with *Aristotle* in the fift Chapter of his Booke *de sensu & sensili*, that in the pure and sincere Elements there is no odour at all. *Aristotle* in the beginning of the chapter rendreth the reason, because they can haue no Tast vnlesse they be mingled: for the Taste and the Smell, that is, the sapour and the sauour or odour doe arise out of the same matter; yet so that in sapours there is more moysture, in odours more siccity: notwithstanding in odors the siccity is not at any time without some humour, for those things that wither and are torrified do loose their odours, as may appeare in the ashes of Iuniper, for as soone as all the humour is consumed, the odour or smell vanisheth also therewithall. Againe, some that are ouer-dryed recouer their smels by the permixtion of moysture.

But

But that in odoriferous things the ſiccity is predominant, may be prooued, becauſe ſuch ſweete ſmelling flowres or what elſe you ſhall name, become without ſmel if they be too much moiſtened: hence it is, that *Roſes* gathered in the raine do ſmell verie litle, nothing at all in comparíſon of the fragrancie of thoſe that are gathered in faire and dry weather. That alſo is the reaſon why in Egypt the flowers are not ſweete becauſe the aire is moyſt and cloudy by reaſon of the waters of *Nylus*. On the contrary the hot Climats of the Eaſt as *Arabia*, *Syria* & the *Indies* do bring forth Spices and other plants of excellent and delicate Smels. It may be obiected ther are many waters which are verie odoriferous, now no man will denie but that in water the moiſture exceeds the drought. VVee anſwere that in water the odour is onely potentiall and that the heate eleuateth or raiſeth vp from out of them a vapour or exhalation wherein the ſiccity preuailes ouer the humidity, and in this vapour is there an Actuall odour. The Reaſon is, becauſe this mooueth the Senſe, but the other odour which is in the water cannot mooue the ſenſe vnleſſe it exhale together with the vapour and attaine vnto the organ.

That drought is predominat in odours.

Why in Egipt the Flowers do not ſmell.

Obiection.

Solution.

The truth of this we may eaſily admit if we draw into our Noſethrils a little ſweete water, for ſo we ſhall not ſmell the odour thereof, becauſe of neceſsity a vapour is required to actuate the odour.

Moreouer, that all that odour is potentiall which conſiſteth not in a vapor but lurketh as yet in mixt bodies, may be conuinced by inuincible argument. For *Ariſtotle* in the 5 chapter of his Booke *de ſenſu et ſenſili* ſaith, the ſubiect of Sapors and ſauours is one and the ſame. If therefore in odours or ſauours ſiccity be predominant, in Sapors or Taſts humidity, it would follow that two contraries ſhould bee predominant in one and the ſame ſubiect, then which what can be more abſurd?

VVe muſt ſay therefore, that theſe qualities are in mixte bodies not actually but potentially, and that they ariſe out of the mixture as out of their matter: ſo that when wee ſay that ſiccity hath the predominance in odours we ſpeake of that odour which exhaleth into acte out of the mixed bodies, and ſo there ſhall be no contrarietie in that we affirme: neither let any man thinke it abſurd, that we ſay two contraries may be potentially in the ſame ſubiect, for water that is tepide or warme, that is, in a middle temper betwixt colde and hot is potentially both colde and hot at one and the ſame time, for it hath an equall diſpoſition to them both, and the reaſon is, becauſe Potentiall contrarietie breedeth no ſtrife in a Real ſubiect.

Potentiall Odor what it is.

QVEST. XLIX. *Of the Cauſes of Odours.*

ALthough the Nature of an odour doth conſiſt in ſiccity, yet it cannot be at any time without humidity, yea it is generated out of humidity, eleuated or raiſed vp into vapours by heate, ſo that there can bee no odour vnleſſe the force and efficacie of heate do boile, raiſe vp and attenuate the humiditie. And this all Herbaliſts acknowledge for a rule, (to wit) that all thinges that Smell ſtrongly are hot, ſo that from the vehemencie or remiſneſſe of the odour they do in Hearbs diſtinguiſh the degrees of heate. So ſaith *Ariſtotle* in the 12 probleme of the 12 Section, ſtrong and ranke-ſmelling ſeedes are hotte becauſe the odour proceedeth from Heate. The like alſo *Galen* affirmeth in the 22. chapter of his fourth Booke *de Simplicium Medicamẽtorum facultatibus*.

Heate is the efficient cauſe of Odours.

A Rule for Herbaliſtes. *Galen.*

Experience alſo manifeſteth the ſame, for perfumes are more fragrant when they are Hot then when they are Colde, and in hotter ſeaſons yeelde a ſweeter ſmel; which is an Argument that the moiſture is better boiled away, and that there is greater plentie of Odour raiſed vp in the aboundance of exhalations which cannot bee looſened and freed from the bonds of the matter wherein they are vnleſſe it be by heate, for cold doth binde and ſhut them vp, neither ſuffering them to yſſue out of their ſubſtances, nor giuing them way to attaine vnto the organ of ſenſe. And after this manner *Plutarch* in the 25 Chapter of his Booke *de Cauſis Naturalibus* aſſoyleth the queſtion, why in a froſtie morning Hounds cannot hunt ſo truly as in open weather.

Sweet things ſmell moſt when they are hotteſt.

Why Hounds cannot hunt in froſt.

But it will be obiected, if the odour bee not a fumide exhalation what neede hath it of moiſture and heate which are the cauſes thereof? VVe muſt remember that whereof wee were admoniſhed befo e, That Odours in mixt bodies are onely potentially & cannot be produced into an acte vnleſſe they yſſue out of them: wherefore being an accident it cannot yſſue out of his ſubiect wherein it was potentially, vnleſſe ſome other ſubiect doe accom-

Obiection.

Solution

accompany it: for saith the Philosopher the *Being* of an accident is to *bee in*. For out of their subiect they are nothing. This subiect therefore which produceth the odours into acte is an exhalation. An exhalation cannot be raised but by heate out of moysture. It followeth therefore that both heate and moisture are necessarie in the production of odors. Necessary, I say not *per se* as they are odours but *per accidens*, because they cannot actually exist without an exhalation.

Obiection. They vrge further, if an odour be *of* and *by* it selfe nothing, then there can be no knowledge thereof, for there is no knowledge of that which is *Non ens* or without being. Againe, a substance *per se* or by it selfe cannot be knowne, and therefore (say they) we take away euen out of the vniuersall Nature all Science, for whatsoeuer is, is either a substance or an accident, third thing there is none. Indeede we grant, that of an odour considered by it selfe and separatedly there is no knowledge, for so considered it is nothing, neither doth it fall vnder Sense, but as it is ioyned with the exhalation it mooueth the Sense and also falleth vnder Science or knowledge. In like manner Accidents separated from their substances, and substances separated from the Accidents doe not fall vnder Science but each by other is mutually knowne and demonstrated.

Solution

No knowledg of an accident without the substance

QVEST. L. *Concluding that Fishes do not Smell.*

An obiection of the *Peripatetiks*. SOme *Peripatetian* (saith *Placentinus*) may obiect on this manner. If an Odour haue Actuall existence onely in exhalation, so that without it it cannot mooue the sense, then what shall wee say to Fishes which liue in the water where there are no exhalations to be found? For *Aristotle* in the beginning of the fift chapter of his Booke *de Sensu & sensili* saith, that there can be no fumid exhalation made in water. The reason is, because as soone as ayre is engendred in water it riseth vp out of it in a bubble. VVe may answere, that the Fishes do not liue in the pure and neate element of water, but in a water compounded of foure Elements: being therefore compounded there is some fire in it, Fire alwayes woorketh, that worke consumeth moysture, and such consumption is absolued by exhalation or eleuation into vapors.

Water consisteth of foure Elements.

Seeing therefore, that in water there may be found such euaporation, it may be haply imagined that by it the Fishes do apprehend Odours.

But (saith my Author) it may be this thredde is too hard twisted, or too finely spun, because first wee must acknowledge that the Fishes smell is wonderfull dull because of the predominance of moysture and colde in the VVater. Againe, I doubt it is ridiculous to ioyne Fire and water, two contraries in the same subiect, which is against the law of contrariety.

And surely this blame we should worthily deserue if we should make the Fire & water equall in their degrees. But wee giue the preheminence vnto the water, and say that the Fire as also the other Elements do put their qualities vnder his girdle. I doe not say that the qualities of the Fire are extinguished or quenched out by the water, but they are remitted or abated, for fire worketh perpetually whersoeuer it is, and raiseth vapours although they be neuer so small, for this action necessarily followeth the essentiall forme of Fire, so that if you separate it from the Fire, you take away his whole substance.

The fire is remitted not lost in the water.

Obiection. Some Philosophers are of opinion, that the foure Elements are onely potentiallie in compound bodyes, and therefore haue onely potentiall vertues, so that Fire which is onely potentially in water cannot actually worke vpon it. But wee Answere, that if the VVater being actually compounded of foure Elements, those Elements must necessarilie bee in it Actually, for that vvhich is potentially cannot make an Actuall Beeing or Existence.

Solution. But we will say, if the water be mixed with fire, why doth not the fire warme it? Surely it doth warme it although it bee not able to remooue all the coldnesse of the water that it should appeare warme vnto the Touch: for if the water were pure and sincere, it is certain that it would bee much more cold then our water is.

Why Well-water is warm in Winter. And this may bee proued by well water which is somewhat deepe within the Earth, for they are hotter in winter then they are in Summer; the reason is, because in winter the surface of the earth is condensed or closed vp so that the internall and elementary heate is preserued within the earth, which in Sommer when the face of the earth is loosned and relaxed issueth into the Ayre. Hence also it is that water after it is once heated ouer the

fire,

fire, would sooner freeze then other which is newly taken out of a Riuer, because in boyling ouer the fire the inbred heat of the water vanisheth because the parts are relaxed or disunited, but in fresh spring water the natiue heat remaineth which preserueth it from freezing. Now these things could not be thus, except that fire were actually in the water, and did also actually heate it; notwithstanding the Phylosophers may in some sort be held excused, because the pure elements distinguished seuerally one from another are in compound bodies potētially, for actually pure elements are not in them. But you will say, that because of the fire which is naturally mixed with the water, there is in the water some litle odour, and that litle odor Fishes do perceiue. But this canot be, for man cannot smell in the water, if fishes therefore could, it would follow that the Sense of Smelling was more perfect in Fishes then in men which is vtterly false. Neither is it any answer to say that the water hath odors therein: or is odorated in respect of of the Siccity, because this Siccity is only potential and vnlesse the humidity which is actually and predominant there be consumed it shall neuer be able to mooue the Sense, for actuall odour requireth an actuall Siccity, and that actuaally predominant. But some man may obiect that the fire which is in the water, rayseth vp exhalations and so odours.

The Phylosophers excused

I grant indeede that in water exhalations may be generated: but none such as *Aristotle* vnderstandeth, that is odoriferous, because those exhalations are meerely vaporous wherein the Siccity is yet actually ouercome by the humiditie. But humide exhalations which are the subiects of actuall odours are neuer found in water, which also *Aristotle* confesseth. Notwithstanding the same *Aristotle* prooueth that fishes doe smell, because they make choyce of their meat, as if he should say, that they choose their meate by their Smels,

The difference betwixt moyst and dry exhalations.

But to returne to that wherefrom wee are digressed, and at length to determine this controuersie, wee say, that Fishes may so far foorth Smell as the water wherein they liue doth communicate with the Ayre and Fire: for seeing nothing can either bee generated or nourished by a simple element, it must needes follow that Fishes being ingendered and nourished in the water, that water partaketh of the vigour and substance of the rest of the Elements. And this is also manifested by the reciprocall transmutation or change of one Element into another. for no man will deny but that rarified water turneth into Ayre, and Ayre rarified into Fire, which could not possibly bee if the water were pure and vnmixed, for it cannot be imagined how it should receiue or put on, a diuers, yea a contrary nature wherewith it hath no affinity or familiaritie.

Fishes cannot smell in pure water.

But if any man shall persist and say that the Sea which is the habitation of Fishes, is the pure and sincere Element of water, free from the commixtion of other Elements, then I say, saith *Placentinus*, that Fishes cannot Smell at all. My reasons are, first, because no Sense is mooued but by obiects, but in water which is not adulterated with mixture of any *heterogeny* body cannot produce an obiect of smelling, for odours are in that which is dry, now what is more moyst and freer from Siccity, then pure and simple water. Againe. if odoriferous things by too plentifull effusion of moysture do loose their odour, how can pure and siucere water haue any odour therein. If therefore Fishes doe smell as *Aristotle* and other classicke authours doe testifie, it must needes bee in reguard of the Siccity which commeth from the permixtion of Ayre and Fre.

If any man shall obiect that water hath no smell in it, because a man cannot perceiue the odour thereof, though hee snuffe it into his Nose, hauing notwithstanding a greater perfection of this Sense the Fishes haue. I answer, that Fishes and those creatures that liue in the water doe smell without respiration or breathing, and without those many helpes of the Organ which are in men.

Fishes smell without respiration.

Moreouer, the water being to Fishes a familiar Element, a little odour mixed therewith may mooue and stirre vp their senses, whereas in men there must bee a hot steame raysed from that which is odoriferous, there must be also Respiration through the Nose to conuay the same steame through the spongie bone vnto the mammillary processes before this Sense in them can be mooued.

But whereas *Aristotle* absolutely concludeth that Fishes doe smell, because they make choyce of their meate, that consequence we cannot so well approue, for the choyce or election of their meat may proceede from another cause. When wee are to buy any victuals which we may not Taste, wemake choyce by our eyes, beleeuing that that which is best coloured is also best tasted; why should we not therefore think that Fishes may make choyce of their meat by their sight.

Againe, all creatures by an instinct of Nature doe desire and seeke after that Aliment

How Fishes choose their meat by their sight. By instinct as the infant.

which is proportionable vnto them, for what teacheth the Infant in the wombe to drawe vnto it the mothers blood rather then the rest of her humors. Is it the smell of blood? Nothing lesse, for the Infant doeth not smell at all; yea it draweth the nourishment into the Liuer through the vmbilicall veine by a naturall instinct. After the child is borne what maketh it to choose the mothers milke before all other nourishment. Is it the odour or smell of the milke? No, for we see that when an Infant is layde to the breast, hee suddenly with a kinde of Naturall force laps his tongue about the head of the breast and suckes very strongly. Shall we attribute this work of the Infant to the Smell rather then to an instinct of Nature? By no meanes, for if you deceiue a childe with a suckling bottle or any such thing like the nipple of the mothers breast, as soone as euer hee tastes that which is therein to differ from the Aliment which he naturally desireth he will presently cry and not be appeased till he haue his mothers breast againe. And thus much shall be sufficient to haue spoken of the causes of odours and some difficulties coincident with them. Now wee proceed to the differences.

QVEST. LI. *Of the differences of Odours.*

Differences of odours very nice.

TO distinguish the particular kinds and differences of Odours, & to giue their proper names is altogether impossible, partly because the Sense is but dull, and partly because of our owne ignorance, which the best Philosophers haue not beene ashamed to confesse.

Wherefore those that haue written of this part of Philosophy considering how imperfect our Sense is, to make fitte distinctions of this obiect; seeing wee can smell nothing but that which doeth vehemently goade and affect the Sense: they haue thought good to distinguish the kindes of odours improperly and by way of translation by the differences of Sapours and Tastes: neither haue they done this without good ground; for between Sapours and Sauors, as in the name, so in the nature there is a great affinity, analogy and proportion, insomuch that the odour or sauour dependeth vpon the sapour or Taste. So sayth *Aristotle* in the fift chapter of his Booke *de sensu & sensili*, there is no bode odoriferous which hath not also a strong taste, defining that to be odoriferous or able to moue the sense of smelling, which hath in it power to diffuse a sapide siccity, & a while after he sayth, *If therefore any man shall esteeme both (to wit, ayre and water) moyst, it woulde followe that odour will bee nothing else but the Nature of sapide siccity residing in moysture.*

Therefore referred to tasts

The kinds of odours.

The kinds therefore of Odours which fall vnder our Sense are these. Biting, Sweete, Sowre, Tart and Fat. As for rotten smelles, these sayth *Aristotle* in the place before quoted, are proportionable with bitter Tasts, because as bitter things are hardly swallowed, so rotten or stinking smels are not receiued into the Sense without a kind of regret and loathing. There are two other differences of odours: the first is common to bruite beasts and by accident doeth mooue pleasure or paine, as those odours which together with the steame do arise from meat, which are pleasant to those that are hungry, and vnpleasant and offensiue to such as are satisfied.

The other kinde is of it selfe pleasant or vnpleasant, as the smell that breatheth from flowers, and this is proper to men alone, for they doe not prouoke the appetite more or lesse, but rather by another kinde of satisfaction doe dull and appease it. Yet wee must not beleeue that all the differences of Tastes may be applyed to odours, for who euer said that he felt a salt smell.

Finally, Odours are either Naturall or Artificiall; Naturall odours are those which are naturally in the bodies; Artificiall are such as Apothecaries vse to make for pleasure or for Physicke of the commixtion of many spices, and these we call compound odours, the other simple.

QVEST. LII. *Of the Medium or Meane of Smelling.*

The Philosophers opinions.

IT hath not yet been called into question whether the smell standeth in need of a *Medium* or no. All men taking it for granted, that a *Medium* is required, partly subscribing to that Axiome so often before itterated by vs. That *the obiect immediatly touching the Instrument maketh no Sensation*; partly because in the 97. Text of his second booke *de anima*, *Aristotle* speaking particularly of the Smell, hath assigned thereto a determinate *Medium* or Meane, for in that place hee doth

doth not onely take away the doubt whether this Senſe be made by a *Medium*, but withall he declareth by what *Medium* it is abſolued and perfected. With him therefore as there is great reaſon we alſo conſent. For Odour hauing his reſidence in a fumide exhalation, with which exhalation the Odour exhaleth out of the bodies: that vapour cannot accompany the Odour vnto the Organ, eſpecially where the diſtance is any thing great betwixt the body, out of which the odour iſſueth, and the organ of Senſe, but it muſt be diſsipated vnleſſe it were preſerued by ſome *Medium*, yet euen that *Medium* doth not ſo preſerue it, but by degrees it is diſsipated and vaniſheth away. Wee conclude therefore that the Senſe of Smelling ſtandeth in neede of a *Medium*. But what this *Medium* ſhould be, that ſaith *Placentinus*, I am not reſolued of although I am not ignorant, that all Philoſophers with one conſent doe agree herein with *Ariſtotle*, who ſaith, this *Medium* is double, to wit, Ayre and Water.

Confirmed. What is the *Medium* of Smelling.

Concerning the ayre, it is without controuerſie the *Medium* of Smelling becauſe when we draw our breath, we do at the ſame time alſo Smell, & beſide the Odour that exhaleth out of the mixt body, is not diffuſed into all dimentions, but only that way which the ayre is diffuſed. A certaine ſigne that the ayre is both the *Medium* and the vehickle of Smels.

The ayre approued.

Concerning the water *Placentinus* maketh ſome doubte, although *Ariſt.* in his 2 Booke *de Anima*, & eſpecially in the 8 chap. of his 4. Booke *de Hiſtoria animalium*, doth ſtriue earneſtly to proue that to fiſhes, the water is the true *Medium* of Smelling. His foundation is, that thoſe creatures which liue in the water do Smell, which if it be ſo, it is neceſſary that there muſt be alſo a *Medium*, wherein the Obiect ſhould be tranſported. That *Medium* cannot be Ayre, for ayre as ſoone as it is generated in water, doth exhale or bubble vp, as the ſame *Ariſt.* teacheth in the 5 chap. of his Booke *de Senſ. et Senſil.* from whence he concludeth, that for Fiſhes the water muſt needs be the *Medium*. And truly the conſequence were certainely and vndoubtedly good, if the foundation and ground where-vpon he raiſeth it be true. But we haue called that into queſtion before. Now I will adde only one argument, and that taken from the Nature of a *Medium* on this manner. All Odour hath his exiſtence in ſiccity, & therefore requireth alſo a *Medium* that is dry, leaſt the Obiect ſhould looſe his odour, for it is the office of the *Medium* to conſerue the Obiect, but water being moyſt is no way fit to conſerue the dry Odour, in reſpect of the contrariety betwixt them, vnleſſe a man will be ſo debaſed as to ſay that one contrary can be the *Medium* vnto the other, which is as much as if he ſhould affirme that contraries doe not mutually impugne, but cheriſh and foſter one another. Seeing therefore water which is moyſt muſt needes extinguiſh or diſſolue the Odour which is dry, it cannot poſsibly be a competent *Medium* for it. Hence appeareth the inualidity of *Ariſtotles* foundation, to wit, that Fiſhes doe Smell. It remaineth therefore that the ayre onely is the *Medium* of Smelling.

The water queſtioned. *Ariſtotle* for it.

Placentinus againſt it.

QVEST. LIII *After what manner an Odour affecteth or changeth the Medium.*

IT is a great controuerſie amongſt the Maſters of Philoſophy, how the odorable Obiect doth change the *Medium*, that is, whether that alteration be *Reall* or *Intentionall*. *Auerhoes* impugning *Auicen*, ſaith, it is done *Intentionally* as a colour is made of that which is coloured, and hee reaſoneth on this manner. If the Odour ſhould bee tranſported through the ayre together with a body, then would there be a penetration of bodies which is impoſsible to be and abſurd to ſay. But *Auerhoes* is deceiued, becauſe an Intentionall Obiect cannot really moue the Senſe; Now it is manifeſt that we Smell really. That which he obiecteth concerning colour, wee haue diſputed already in the precedent controuerſies. Adde hereto that Intentionall *Beings* are produced from the Soule, and doe depend thereon, and therefore they are called *Entia rationis* Notions of Reaſon. By this conceſsion therefore it would follow, that the Obiect is in the vnderſtanding before it is in the Senſe, if it were true that a Reall obiect did make an impreſsion of an *Intentionall* Odour in the *Medium*.

Did not *Auerhoes* remember that ruled Axiom, *Nihil eſt in intellectu quod non prius fuerit in Senſu? That there is nothing in the mind which is not firſt in the Senſe?* And to what purpoſe ſhould any thing that is in the vnderſtanding be remitted or returned vnto the Senſe, ſeeing things are therefore receiued into the Senſe, that they might attaine vnto the vnderſtanding. And whereas *Auerhoes* ſaith, that there would be penetration of bodies, if the adorable Obiect did really alter the *Medium*. I anſwer the conſequence is not good: for the ayre being a moſt liquid Element, doth eaſily yield to any body. Adde beſide that a fumid exhalation being mingled with the ayre, may be caried and recaried with it hither and thither. After this manner alſo, the opinion of *Philoponus* and *Iandunus*, may bee refuted, who doe affirme that the Odour may really together with the exhalation be caried a good ſpace through the *Medium*, marry the reſt of the *Medium* which attayneth vnto the organ of Senſe, is altered onely intentionally by the Odour, for a reall Being doth alwayes worke really, and that which is Intentionall dependeth vpon our vnderſtanding. But if ſome part of the *Medium* were really changed, and other parts intentionally

Philoponus & Iandunus refuted.

nally. What is the reason why in remote distances a great tract of the *medium* is really affected; and in little distances (as when we moue the obiect to our Noses) but a little.

As also *Aegidius.*

Aegidius was of opinion that the odour was really produced in the *Medium* as is the Sound, which sayth *Placentinus* is vtterly false, for not so much as colour, which is simply and immediately made out of the mixtion of the first qualities, can possibly after any manner be receiued in the ayre. How then shall odour which is a second quality bee generated in the ayre. Furthermore *second qualities cannot mutually worke one vpon another*: for one white cannot produce another white, no more can one odour which expireth or breatheth out of a body beget another odour in the *Medium*.

With *Ammonius & Boetius.*

And for this cause we also most disclaime *Ammonius* and *Boetius*, who say that an odour may passe out of one subiect into another; for although it proceede together with the exhalation out of the bodies into the ayre, yet it doth not change his subiect nor flit into another. But the ayre being made vapoury sustayneth the exhalation together with the odour, conserueth it and is a vehickle vnto it: yet when the vapour is dissipated the odour vanisheth together therewith, which would not happen if it were fit to flit or moone out of one subiect into another.

Auicen redeemed.

Wee therefore with *Auicen* doe resolue that the *Medium* is really changed: for that the odour doth really yssue out of the mixed body we haue proued before: from whence it followeth necessarily that some part of the *Medium*, to wit, that vppon which the odoriferous exhalation doth immediatly worke is really affected. Againe, Odours doe really attaine euen vnto the braine, and therefore there is no question but that the *Medium* is really affected. Those therefore that say it is affected intentionally, as also those that confesse some part of it be affected really, but other parts intentionally, haue sit downe beside the Cushion.

The *Medium* is really affected.

But although the odour proceede really out of the subiect and reach really vnto the braine, yet no man must conceiue that the odour is diffused through the whole *Medium* from the obiect euen vnto the organ, but it is wafted vpon the wings of the wind or transported by the motion of the ayre. That an odour attayneth really vnto the braine may be proued, because such odours do sometimes helpe and sometime hurt. The detriment seemeth not to proceed from the odour but from the quality of the subiect which accompanieth the odour, that is, the exhalation. For the odour being a quality cannot haue in it that hurtfull quality vnlesse you will graunt that a quality can bee in a quality. Neither doeth the quality onely of exhalation affect the braine, but sometimes some seedes of the very substance of bodies that are of subtle partes are transported in the exhalation, which setling in the braine brings foorth fearefull accidents and strange effects, as it did in him who smelling oft vpon Basill had a Scorpion bred in his braine. It is therefore necessary we should beleeue that the odour is really *perceiued* by the organ. For confirmation whereof wee may also adde this argument, because all knowledge or science hath his originall from the Senses. Now science is of a reall not of an intentionall Being. How then shall science which hath a reall subiect take his beginning from the Senses if they receiue nothing but that which is Intentionall.

For they really affect the braine.

Confirmed by a strange instance.

Science is from the Senses.

It is therefore manifest that the Senses doe not *perceiue* their obiects intentionally but really; and by consequent that the *Medium* is also really affected.

Obiection.

But it may be obiected if the odour be really imprinted in the Organ, then there is no neede of an externall *Medium*, and beside, that *axiome* will be false, That the obiect vpon the Sense doth not make Sensation.

Solution.

We grant indeed that there is no neede of a *Medium* which should be betwixt the reall odour and organ, but the vse of the *Medium* is for the conseruation, preparation and transportation of the odour.

QVEST. LIIII, *What is the true and principall Organ of smelling where Aristotle is confuted.*

GAlen hath often testified that in euery perfect Organ, there may be obserued diuers kinds of parts. Of these parts some bee principall, to which the action is primarily to be attributed. Some againe bee such which make the action more excellent, and others doe conserue the action.

Now that the Nose is the Organ of Smelling no man will deny, but be-

cause

cause diuers parts doe coucurre vnto the constitution of the Nose, to wit, bones, gristles, muscles, small nerues, membranes, and the mammillary processes; it is therefore controuerted betwixt the Physitians and Peripateticks to which of these parts, as to the chiefe cause, the action is to be ascribed.

A difference betweene the Peripateticks & Physitions.

Aristotle in his second booke *de Anima*, and in his booke *de sensu & sensili* doth affirme that the externall Nose which is conspicuous in the face, is the chiefe Organ of Smelling; wherein he conceiueth there is a couer like a value which is neuer opened, but by inspiration, whence it is that we haue no Sense or preception of odours but when wee inspire.

Galen in his booke *de odoratus Organo* doth in the three and foure whole chapters vehemently inueighe against *Aristotle*, where hee teacheth that indeede the externall Nose doth something conferre vnto this sense of smelling, but the chiefe Organ thereof is within the scull; And for the confirmation of this conceite, he vseth an elegant and inuincible demonstration from the enumeration of the seuerall pars of the Nose. For, neither saith he, can the bones, nor the grystles, nor the membran, nor the nerue dilated through the membrane be the true organ of the Smell, and therefore no externall part of the Nose can bee. As for the bones and grystles they are so farre from hauing the Sense of smelling that they haue not so much as the faculty of Touching allotted vnto them: they therefore are farre vnfit for the performance of this function. Againe, euery ἀρσθητήριον or Organ ought to communicate in nature and conformation with the sensible thing, that so the Organ might bee more easily altered by it. But nothing is agreeable to the nature of Odours, but that which is vaporous: betwixt the nature whereof and that of bones and grystles, there is very great distence.

Galens demonstration.

As for the membrane which inuesteth the Nose; it is indeed endowed with most exquisite Sense of Touching, yet it is to crasse and thicke, for the reception of such subtle obects as odours are. And beside this membrane or coate is also common to the Tongue and the Palate and mouth, but in those parts it hath no Sense of odors. Again if this membrane were the true instrument of Smelling, then it should continually perceiue the appulsion or beating of the odours, but there is no preception of odours, except when we doin spire; for though you fill the Nose full with Muscke or Ambergreese or other odoriferous bodyes; yea though you should annoynt the whole membrane with sweet oyles, yet you shal haue no preception of odors except you draw in the Ayre by inspiration; wherfore we conclude that the principall Organ of Smelling is not placed in the bone or grystle or membrane, or any other part of the externall Nose.

The membrane is not the instrumét of smelling.

As concerning that couer or value (whereof this great Phylosopher dreamed) which is open when we draw in our breath, and shuteth when we hold our breath, *Galen* doth in no sort acknowledge it in the aboue named places, neither will any well skilled in Anotomy admit of it. But yet put the case that there be such a value in the interiour part of the nosthrils and that it doth sometimes open it selfe to make a passage for the ayre and vapors which we draw in, and that it shuts againe when we cease our inspiration, then surely the motion of this couer must either be animall or naturall, or violent. That it is voluntary, no man will say, because there is no neede of such a value vnto animall motion. And beside all animall motion is at the command and in the gouernement of the soule, and obedient vnto our will and appetite, but this value is neuer opened but when wee draw in the Ayre. Moreouer, the immediate instrument of voluntary motion is is a muscle, but there are no muscles to be found in the depth of the cauity of the nosthrils.

That there is no value. Reason.

Neither is this motion Naturall as is the motion of the values of the heart. For the heart is perpetually mooued and performed by it owne instinct and not by our will.

If you thinke it be violent because it is forced by the inspired Ayre, then giue eare vnto *Galens* obseruation ouerthrowing this conceite. For, saith he, if you shall force either much ayre or any liquour into the nose through a pipe and hold your breath, why is not the value opened if there be any such extant, and why should there not be a perception of those odours in the Nose. If the Perepatetickes shall insist, & retort our owne argument, and fight against vs with our owne weapons, and say, if the Mammi lary processes bee the principall Organ of Smelling, why doth not sweete Ayre being driuen with force and violence through a pipe moue the Sense.

Obiection. Solution.

Galen answereth, that the aire being blowne and forced through a pipe, if we hold our breath doth neuer reach vnto the Braine, because all partes of the Braine are full of Ayre

when the Braine is contracted by expiration, but when the Braine is dilated by his inbred power all the spaces are enlarged, and so for the auoiding of vacuitie are filled with inspired aire. The aire therefore cannot attaine vnto the processes and Ventricles of the Braine but onely by inspiration, because except the Organs be dilated, how shall the aire passe through those pores which be already full of aire? Now if aire cannot bee brought but by Inspiration vnto the Mamillary processes, then surely cannot the species or kindes of odours: for as the character and quality of the sound cannot bee carried vnto the Organ of hearing but by the meanes of the intermediate aire, no more can the qualitie of odours attaine vnto the organ of Smelling. Let *Aristotle* therefore patronize his owne opinion himselfe.

The true Organ of smelling.

VVe with *Galen* and the Physitians do resolue that the principall organ of the smell is seated within the Scull and a portion of the Braine, namely, those processes & two bunching productions which are like to the Nipples of a womans pap, and doe reside or rest vpon the higheſt bone of the Nosethrils.

The Mammillary processes Authoritie.

And this hath *Hippocrates* bewrayed in his Booke περὶ ἀρχῶν, where he saith. That the Braine doth smell the odour of dry things together with the aire, drawing the same thorough two cartilagineous or gristly bodies. And to him doth *Galen* beare witnesse in his booke *De Odoratus Organo*, in his eight booke *de vsu partium*, and in his first booke *De Sympt. Causis*. And lastly sound reasons doe also euince this our opinion. First, that part is to be accounted the principall which hath a peculiar substance, figure & composition.

Reasons prouing this first

VVitnesse *Galen* in his sixt booke *de Placitis Hippocratis & Platonis*. But the processes amongest all the partes of the nose haue a peculiar nature, figure and composition, which you cannot finde in any of the other. But the Bones, Gristles and Membranes are euery where alike. Wherfore the principall cause of this action of Smelling is to be ascribed to the Mammillary processes.

a Reason

Againe, there is no part in the nose which can be altred by odors, but these processes being full of spirits and vapours doe with facility receiue the species of odours, and because they are of neere a kin to the Nerues, they haue a kinde of Notion of that qualitie which they perceiue.

Auerrhoes. disprooving *Galen*. First reason

Auerrhoes being a bitter enemy to Physitians in the defence of Aristotle endeauoureth to ouerthrow this opinion of *Galen* but with verie easie Engines. If (saith hee) the Mammillary processes were the organs of Smelling, then the odor of those things which are bruised in the mouth would be smelt when the Nosethrils were obstructed and shut, because there is a manifest passage for the aire open from the mouth & palate vnto those processes.

Second.

Moreouer, the odour of those meats which are contained in the Stomack would be perceiued, for there do certaine vapours exspire therefrom vnto the Braine, during the whole time of the concoction. And lastly, such creatures as wanted these processes would also want the sense of Smelling. But I thinke we may fully satisfie these obiections on this manner. First, although there bee a way open out of the mouth into these processes, yet

Third. *Galens* answer

notwithstanding there is not any perception when the nosethrils are shut, because the odours should first be offered vnto the Nosethrils and there be prepared, without the nosethrils therefore there can be no perception of odours, and yet it dooth not follow that the Nosethrils therfore are the principall organ of this Sense. Euen as without the watery humour no vision can be made, and yet no man will say that it is the principall Organ of Sight.

Why we doe not feele that which is in our mouth & Stomacke

But besides this, there is another reason why when our noses bee shut, those thinges which are chawed in the mouth and are contained in the stomacke are not smelt, to wit, because the odour being as it were drowned and strangled with the excesiue humiditie of the mouth cannot make shew of it selfe, nor imprint his natiue species and forme in the Sense of Smelling. For Odour is (as *Aristotle* himselfe in the second Booke *de anima* affirmeth) of a drie thing, as a Sapor of a moist thing. So those which are troubled with the *Coryza* or a distillation out of the head into the nose which we call the *pose*, doe not perceiue the formes of odours.

Moreouer, that vapour which is brought from the Stomacke vnto the Braine is not perceiued by the Smell, because such vapours are too familiar and too well acquainted with the Braine, so that no alteration can be made by them. In like maner those which vse to eate much garlicke haue no sense of their owne stinking breath.

As

As for *Auerrhoes* his laſt obiection, that many creatures wanting theſe proceſſes, yet do perceiue the ſauour of odours, is not any whit repugnant vnto *Galen*. For he ſpeaketh onely of perfect creatures, and not of imperfect, which as they can ſtand without bones and liue without Lungs, ſo there is no reaſon but they may reſpire and breath without nosthrils or theſe Mammillary proceſſes. The concluſion.

We conclude therefore that thoſe two ſwelling mammillary proceſſes are by good right accounted the principall organs of ſmelling, yet notwithſtanding wee affirme that there canne bee no perception of odours without the help of the nosthrils and the ſpongy bone. And thus much of the Senſe of Smelling. Now we proceede vnto the Taſt.

QVEST. LV. *Whether Taſte be the chiefe action of the Tongue.*

ALbe it be commonly knowne that the Taſte is an action of the Tongue, yet it ſhall not bee amiſſe to make this truth ſomewhat more manifeſt, for the Tongue is ordayned for many vſes. Firſt to articulate the voyce. Secondly, for maſtication or chewing, becauſe it contayneth the meate within the mouth, and rowleth it vnder the mill-ſtones of the Teeth. Thirdly, for the Taſte and dignotion or perception of ſapours. The queſtion therefore ſhall bee, which of all theſe is the principall action for which Nature ordayned this inſtrument, becauſe we aſsigne vnto one part but one principall action. That therefore is the principall action, for which the Tongue was primarily inſtituted by Nature. And that Action is primary which is moſt neceſſary, the rule of Nature being firſt of all to prouide for the neceſsity of the creature. The action therefore which is moſt neceſſary is alſo the principall action. The diuers actions of the tongue. Which action is principall.

I know well what great vſe we haue of ſpeech, and how miſerable the life of a dumbe man is, yet becauſe other actions are more neceſſary, therefore wee cannot beleeue that ſpeech was the principall end for which Nature ordayned this Organ. Now that other fũctions are more neceſſary then ſpeech we need not to doubt, becauſe thoſe are abſolutly neceſſary to life, this onely to better life. That the other functions are abſolutely neceſſary, for the conſeruation of life is hence manifeſt, becauſe brute beaſts cannot liue without them as they doe without ſpeech. Speech is not the principal action of the tongue.

But amongſt thoſe other functions, which is the moſt neceſſary, is harder to diſcerne, yet to ſay truly maſtication is not an action of the Tongue, and therefore wee will not ſtand in this place to diſpute the neceſsity of it. For it is an inſtrument of maſtication but by accident, as it rowleth the meate vnder the Teeth that chew it. But a principall action belongeth not to a part by accidẽt, but by & of it ſelfe. Again, it were abſurd, to ſay that the principall action of ſo noble a member, did but helpe the Teeth to chaw the meate. Adde hereto that maſtication or chewing is not ſo neceſſary to life as Taſting is for Infants doe ſwallow their meate without chewing, and ſo doe moſt Fiſhes, as *Ariſtotle* remembreth in the eleauenth chapter of his booke *de partibus Animalium*, but without Taſte the creature cannot liue. Not that if their Taſte be loſt, they muſt preſently periſh, (for it was a cuſtome among the Ancients for blaſphemie to cut out mens Tongues and yet they died not) but becauſe all creatures taking delight in ſome one kinde of food or other, when the Senſe of pleaſure is taken away, they abſtaine from thoſe meates, or take but little and ſo pine away to death. And this is the opinion of other men concerning the neceſsity of the Taſte. I, ſaith *Placentinus*, doe rather thinke it therefore neceſſary, becauſe when it is loſt the creature taketh all meates indifferently, & by that meanes is often extinguiſhed by poyſon in ſteede of nouriſhment. Seeing therefore that perpetuall nutrition is abſolutely neceſſary vnto life, therefore Nature ordayned this Senſe, to take the aſſay, which was fit ſhould be very exquiſite, becauſe the Lord it ſerueth, which is Nutrition, was the principall act for which the creature was ordained. Nor Maſtication. Reaſons why The neceſsity of the Taſt. An old kind of puniſhment of Blaſphemy. The reaſon of the neceſsitie of the Taſt.

We conclude therefore that of all the actions of the Tongue the Taſte is the chiefe, and that the reſt are but ſeruants and attendants there-vnto, eſpecially Maſtication.

QVEST. XLVI. *Whether the Taſte differ from the Touch.*

THE Taſte is one of the fiue external Senſes, whereby we diſcerne the differences of ſapours. This Senſe hath great affinity with the Senſe of Touching, in ſo much that ſome haue made no diſtinction betweene them, but haue placed the Taſte vnder the Touch, as the *ſpecies* vnder the *Genus*, for which they haue not onely *Ariſtotles* authority, but very ſtrong reaſon. What Taſt is and how nere a kin to touch

The

Ariſtotles authorities.

The authorities they produce are theſe, *Ariſt.* In the ſecond Chapter of his booke *de Senſu et ſenſili* ſaith, that the Taſte is a kinde of Touching. Againe, in many places he affirmeth that Taſte is a kinde of Touching, as in the 4. chap. of the Booke before named. In the 64 Text of his third Booke *de anima*. In the 17 chap. of his 2 Booke *de partibus animalium* & in infinite other places. But theſe authorities ſeeme not to bee of any great conſequence, becauſe the ſame Ariſtotle doth oftentimes affirme that all ſenſe is a kinde of Touching; from whence it would as well follow that there is but one Senſe, that is, the Touch, then which nothing can bè more abſurd. Wee muſt not therefore conclude that the Taſte and the Touch are all one, becauſe *Ariſtotle* ſaith, that the Taſte is a kinde of Touch.

Called into queſtion.

It ſeemeth to me notwithſtanding that there is ſomething in it, why particularly intreating in diuers places concerning the Taſt, he calleth it rather a Touch, then the other Senſes, eſpecially in his propper Tractate of this Senſe, whereas he giueth no ſuch attribute to any other of the Senſes. For in his chapter *de viſu* he doth not ſay that Seeing is a kinde of Touch, nor ſhall you finde in the Chapters of Hearing and of Smelling any ſuch matter. Further, this opinion is confirmed by *Ariſtotles* argument, becauſe he aſcribeth the ſame obiect to both theſe Senſes; for in the very beginning of his Chapter *de Guſtu*, that which is Guſtable or fit to be Taſted, is alſo Tangible and fit to be Touched. And comparing the Taſt with the Touch that there is the very ſame reaſon and nature of them both. Yea, that they differ nothing one from another. But in the 28. Text of his 2 booke *de Anima*, hee ſpeaking of ſet purpoſe auoucheth the very ſame, for hee ſayth not onely that that which is Guſtable is alſo Tangible, but alſo that the Touch is the Senſe of Aliment. And about, the end of the ſame text expreſſely naming the obiect of Taſt, hee ſayth, that a *Sapor* is one of thoſe which are *perceiued* by Touching. And in the 63. text of the ſame booke more playnly thus; *Wherefore the Taſt it ſelfe is a kinde of Touching, for it is the Senſe of aliment, now aliment is a body which is perceiued by the Touch.*

And expounded.

If therefore Taſting and Touching haue one and the ſame obiect, ſurely they are one and the ſame Senſe. As from the plurality and diuerſity of obiects, the plutality and diuerſity of the Senſes is gathered, ſo from an vnity and Identity of the obiect it muſt needes be there ſhould follow alſo a vnity and Identity of the Senſe.

They adde alſo an argument gathered out of *Ariſtotle* in the beginning of his Chapter *de Guſtu*, on this manner Taſt and Touching doe equally perceiue that which is moyſt, yea moyſture though it be inſipide ſome ſay may be diſcerned by the Taſt. Seeing therefore the obiect of the Touch may be perceiued by the Taſt. And the obiect of the Taſt reciprocally by the Touch, they muſt not be eſteemed diſtinct Senſes.

Finally, they adde out of *Ariſtotle* that in the 23. text of his ſecond booke *De anima* and in the 68. text of the third booke he ſaith, that the Touch onely is neceſſary for the creature. And againe, in the fourth chapter of his booke *de ſenſu & ſenſili*, as alſo in the laſt chapter ſaue one of the third booke *de anima* he ſaith, that a creature cannot bee without the Taſt; wherefore ſay they, *Ariſtotle* thought that the Taſt and the Touch were both one, otherwiſe there ſhould be a repugnancie betwixt theſe two places.

All theſe particular inſtances out of *Ariſtotle* doe at the firſt bluſh ſeeme to proone that he was of their mind. But if we looke ſomewhat more narrowly into them we ſhal finde that there can bee no ſuch thing gathered from *Ariſtotle* by good and lawfull conſequence.

Anſwer to *Ariſtotles* authorities.

For firſt whereas he ſaith that the Taſt is a kinde of Touch, it is nothing elſe but to demonſtrate the affinity betwixt theſe two Senſes; for if hee had meant that the Taſt and the Touch did not differ in *Specie*, hee would neuer haue ſayd that *Guſtus* was *Tactus quidam*, but ſimply and plainly *Guſtus* is *Tactus*, hee would not haue ſayde that Taſt is a kinde of Touch, but that Taſt is a Touch.

To the firſt inſtance.

Neither are wee to wonder why *Ariſtotle* ſpeakes in this maner rather of this Senſe then of any other. Is it not becauſe none of the other Senſes haue any ſuch acquaintance or familiarity with the Touch as the Taſt hath?

Conſider firſt that the Taſt as alſo the Touch is made without a *medium* ſo are not the reſt of the Senſes. The reaſon is, becauſe as well in the Taſt as in the Touch the obiect muſt touch the Organ, ſo that theire extreme parts are contiguous one vnto another. Hence it is that the Guſtable obiect being aboue that which Taſteth, maketh Guſtation, whereas in other Senſes there is no comprehenſion of the obiect by the Organ ſauing by the interpoſition or mediation of a *medium* or middle body.

The affinity betwixt the Taſt and the Touch.

Finally the obiect of the Taſt is more endowed with Tactile qualities then the ob-

iects of the rest of the Senses as being more corporeall, materiall, earthy, and to speake in a word correspondent or answerable to the Tactile obiect, so that *Aristotle* might well say, that that which was Gustable was a kind of Tangible. Seeing therefore this Sense of Tasting hath so many more conditions concurring with the Touch then the other Senses, it was not without cause that *Aristotle* so often compared the Tast and the Touch, and in a manner of speech confounded them. but was more sparing in the collation of the Touch with the other Senses. And hence we may shape an answer to the second authority, for he doth not say simply *Gustabile est Tangibile* but *Gustabile est quoddam Tangibile*, adding a conditional particle wherby he would intimate that there was a great vicinity or neighborhood betwixt these two kinds of obiects, yet notwithstanding that they did so differ that they do not fall vnder one and the same Sense. Answer to the second instance.

The third argument is weighty and difficult, for without any condition or limitation he saith, that a Sapor is perceiued by the Touch, and that the Touch is the sense of Aliment; notwithstanding we answere that *Aristotle* doth not take a Sapor as it is a qualitie properly Gustable, but as it is in a gustable body. For this body is indeede perceyued by the Touch not as it is Gustable, but in respect that beside the Sapour it hath also many Tangible or Tactile qualities. To the third. First Answere

Add moreouer, that the word χυμὸς which *Aristotle* vseth, doth not onely signify a Sapor but also a iuice and humor indued with a Sapour, whence the Physitians call those meates εὐχύμους, not which are well-tasted but which yeelde a profitable and Alimentarie blood vnto the bodie: againe on the contrary they call those meates κακοχύμους which yeeld a bad and vicious iuice, and that disease is called κακοχυμία, when the body aboundeth with euill and vicious nourishment. VVe are therefore to beleeue that *Aristotle* is thus to be vnderstood, because so oftentimes hee testifies that *Sapor* hath his residence or beeing in humidity, or that which is humid and moyst. The 2. answer

I might also say that *Aristotle* speaketh in that place of that Sapour which nourisheth. Now a Sapour as it is a Gustable quality doth not nourish, because that which is incorporeall cannot be turned into a body, but that which nourisheth must of necessity bee conuerted into the body that is nourished. It is therefore no question but that when Aristotle spake of a *Sapor* he meant it *de corpore Sapido*, that is, of a body which was not without Sapors or Tastes. And indeede a Sapid body may nourish. So saieth *Auicen*, that vvhich hath a good Taste doth also nourish, not that the Sapor or Taste dooth nourish, but the substance wherein the Sapor doth consist. Third answer. *Auicen.*

On this manner also is Aristotle to be expounded, where hee saith, that the Touch is the Sense of aliment, for he doth not meane that it falleth vnder the Touch and vnder the Taste after the same manner and in the same respect but vnder the Touch in regarde of the Tactile qualities, vnder the Taste in regard of the Sapor. It is as much therefore as if he saide, *Because the Aliment as it is a body cannot be found without Tactile qualities; the Touch indeede perceiueth these qualities, but it perceyueth not the Sapor as it is a Sapour*. And therefore in the 63 Text of his third Booke *de anima*, after he hath saide that the Touch is the Sense of Aliment he explaineth himselfe after this manner, *But the aliment is a Bodie which is perceiued by the Touch*. To the fourth

Seeing therefore the Aliment is a bodie, it must haue both Tactile and gustale qualities, and therefore may be truely called the obiect both of the Taste and of the Touch, yet is it the obiect of neither Sense as it is an Aliment, but of the touch as it is moyst and dry, hard and soft: of the Taste, as it is sweete, bitter, Salt and the like.

As for the reason which they alledge out of *Aristotle*, I hold it to be of no weight, because *Aristotle* had no such intention; yet we may grant that moysture is perceiued by the Taste not as it is moisture, but as it is sapid: and that insapide moisture or moisture without Taste may be discerned by the Sense of Tasting, that I vtterly deny. To the Fifte.

Concerning the necessity; that which they vrge is meerely friuolous, for Aristotle supponeth that the Touch is simply necessary so that the creature without it cannot subsist: but the Taste is necessary for the Touch, because it is a kind of Touching: yet we do not denie but that the Taste also is necessary *Secundum quid*, as we say in Schooles, that is not of it selfe, but because the creature wanteth nourishment. It dooth not therefore follow that either the Tast and the Touch should be both one, or else that an imputation should be cast vpon *Aristotle* for contradicting himselfe. To the Sixt.

It may be also obiected, that because both the Taste and the Touch are both in one & Obiection.

the

Solution. the ſame Tongue, that therefore they ſhould be one and the ſame Senſe. But the conſequence is not good, for there is no organe of Senſe, which beſide his proper Facultie of Senſation is not alſo furniſhed with the Senſe of Touching. But becauſe the Sēſe of Taſting is not alwaies found where Touching is, and where it is found there is no other Faculty of Senſation. I conclude that not onely all the other Senſes but the Taſte alſo is a diſtinct and different Senſe from the Touch.

QVEST. LVII. *Of the obiect of Taſting.*

The obiect of Taſt is more euident then other ſenſes and why.

THe obiect of the Taſte ſayth *Ariſtotle* in the fourth Chapter of his Booke *de Senſu & ſenſili*, is not onely more euident and manifeſt vnto vs then the Odours are, but alſo then all other Senſible Obiects. The reaſon we may giue out of the ſame place of *Ariſtotle*, becauſe the Taſte is a kinde of Touching, which Senſe in a man is more perfect then all the reſt.

2. ſignifications of *Guſtabile*.

Now the Obiect of the Taſte is that which is *Guſtabile* or *Guſtile*, which worde ſignifieth two things, to wit, a Sapour or quality and affection ſeated in a ſapide body, and the body it ſelfe wherein the Sapour is. But the Sapour is the proper and adequated or proportionable obiect of the Taſte, and therefore *Ariſtotle* appropriateth the word *Guſtabile* to a Sapour. As ſayth he *viſible eſt color, ſic Guſtabile eſt ſapor*, as that which is viſible is a Colour, ſo that which is Guſtile is a Sapour: as if he ſhould ſay, that a Guſtable body is no way Guſtile or to be Taſted, but onely in reſpect of his Sapour. Yet hee oftentimes puts *Guſtabile* for *Sapor*; the reaſon is, becauſe a Sapour hath no exiſtence of it ſelfe, neyther can it moue the Senſe but hath all his being and eſſence in the mixt body. That therfore which he calleth *Guſtabile* is a mixt body, which in reſpect of that quality which is called a Sapour is Guſtile or may be Taſted. Not but that a Sapour doeth by it ſelfe moeue the Senſe, but becauſe it cannot ſubſiſt without the mixt body, for conſidered euen without the mixt body it may be ſayd to be the obiect of Taſt, becauſe it is it alone in the mixt body which moueth that Senſe.

QVEST. LVIII. *Of the matter of Sapours.*

What a ſapor is. 2. kindes of firſt qualities.

A Sapour is a quality ariſing out of the firſt qualities, which alone by it ſelfe is able to mooue the Taſte. Now the firſt qualities are of two ſortes: ſome Actiue, as heate and cold; others Paſsiue, as moyſture and drought. Out of the Actiue qualities the Sapour hath his Efficient cauſe, to wit, heate; out of the Paſsiue his Materiall cauſe, to wit, Moyſture. But leaſt any man ſhould wonder why wee make moyſture which is nothing elſe but an incorporeall quality to bee the matter of Sapours. We anſwere, that wee vnderſtand humidity not in the abſtract but in the concrete. So that haply it were more proper to ſay *humidum* then *humiditas*, for to ſay trueth, a Sapour is not made onely of humidity, but of humidity ioyned with ſiccity, yet ſo that the humidity is predominant.

Sapours are not made of ſimple humidity.

Wherefore *Ariſtotle* ſayth that a Sapour dwelleth in that which is moiſt, as an odour doth in that which is dry; yet he doth not name humidity alōe, nor ſimple ſiccity but both conioyned, and therefore hee rather expreſſeth himſelfe by *humidum* and *Siccum* then by *hamiditas* and *ſiccitas*: ſo that in the one the moyſture preuaileth ouer ſiccity, in the other the ſiccity ouer moyſture.

For thus much doth *Ariſtotle* intimate in his Booke *de ſenſu & ſenſili*, where he ſayth that the vniuerſall nature of Sapour is, that it is a paſsion of the Senſe of Taſting made by that which is earthy, dry, in that which is moyſt. Wherefore humidity being predominant in an earthy ſiccity is properly the matter of Sapors.

1. Obiection

It may bee obiected if in Sapours the humidity muſt preuaile ouer the ſiccity, then thoſe bodies wherein the ſiccity preuailes ouer the humidity ſhould be inſipide and without Taſt. Now there are many in which the ſiccity is predominant, as aſhes, Pepper, Ginger and ſuch like, which yet notwithſtanding haue a very ſharpe and quicke Taſte. Adde

3. Obiection. moreouer that if that were true, then Sapors ſhould not properly belong vnto Aliments; for *Ariſtotle* ſayeth in the 28. Text of his third Booke *de anima*, that hunger is an appetite of that which is hot and dry. An Aliment therefore is not moyſt but hotte and dry, becauſe it appeaſeth hunger. Seeing therefore all men confeſſe that Sapours doe properly belong to Aliments, it ſhould ſeeme alſo that Sapors haue their reſidence not in moyſtur but in ſiccity.

VVe

VVe answere, that an Actuall Sapour, that is, such a Sapour which is instantly fitte to moove the Taste must necessarily bee in moysture. That which they obiect of Pepper, Ashes and such like, we answere on this manner. VVee grant that of themselues they are insipide and haue no Sapour but that which is potentiall, for they doe not Taste till they be chewed, and that is by accident: when as that humour which perpetually remayneth in the mouth and the tongue, prouoketh or produceth their potentiall vertue into Act, but because siccity is in them predominant, therefore they yeeld a sharpe and quicke Tast.

That which they add concerning Aliment is easily answered, For there are two kinds of Aliments; one which satisfieth hunger, another which satisfieth thirst. That which satisfieth thirst is exceeding moyst, and in respect of it that which satisfieth hunger may bee called dry, although it doe not follow that it should simply be dry, yea it is necessary that it should haue so much moysture as the Sense of Tasting doth require otherwise it could not satisfie hunger.

Solution 2. 2. kinds of Aliments.

Finally, wahtsoeuer mooueth the Tast must of necessitie haue an inward moysture wherein it is steeped, although it hath no outward, the reason is that it may melt and diffuse it selfe through the organ of the Sense, for those things that are hard and cannot bee dissolued cannot moove the Sense of Tasting, as wee may conceiue by a rough and torrified tongue such as we see is chopped and blacke in violent Agues, which can not make any certaine estimation of the difference of Sapors.

QVEST. LIX. *Of the efficient cause of Sapours.*

IF the passiue qualities therefore moysture preuailing ouer Siccity is the matter of Sapors. Of the actiue qualityes they haue heate for their efficient cause. For as the simple and pure Elements are of themselues without sapor or odor, so also in the mixt body no such thing would result out of them if euery Element should reserue his owne quality to himselfe; and therefore there is neede of heate to draw out the Sapors out of the concoction of the humidity and Siccity, by which concoction these two are fitly mixed one with the other, neither is it reason that any man should substitute *cold* to this office, for dayly experience teacheth vs that fruites when they are frozen, as Apples, doe vtterly loose their tast; yea although they be thawed and resume their former heate yet their tasts doe not returne. So that cold is so farre from being the efficient cause of Tast, that rather it doth vtterly destroy them. Adde hereto that no fruite attaineth his natiue Tast till it grow ripe, now this ripening is made by heat. It remaineth therfore that heate in as much as it concocteth humidity, and accomplisheth perfect mixtion is the true and onely efficient cause of Sapors.

Heate is the efficient cause of Sapor.

How that is.

Cold cannot be.

Why frozen fruits loose their Tast.

QVEST. LX. *Of the number and order of Sapors.*

ARistotle in the 4. chapter of his book *de sensu & sensili* going about to recite the diuers kinds of Tasts compareth them with colours not because there is any great affinty betwixt them, but because there is iust as many of the one kinde as of the other, and he concludeth them both vnder the number of seuen. Some say there are eight kindes of Sapours, and *Plinie* in the 21. chapter of his 15. booke, reckons vp thirteene. VVe with *Aristotle* will rather reduce them vnto the number of seauen; because, as there may be, and indeede there are infinite varieties of mixtion, so we should draw out of them infinite differences of Sapors, if it were possible accurately to number them; for nothing is so sure as that the differences of Sapors doe arise from the multiplicity of mixtion; for example, out of that wherein heate and moysture are aboundant, a sweete Sapor; out of that that is hote and dry, a bitter and salt Sapor, and so in the rest, as this or that qualitie hath greater or lesse rule in the mixt body, yet alwayes moysture must haue the first place.

How many kinds of Sapors.

As many as of mixtures.

An instance of this we haue in a place of *Galen*, in the sixth, seuenth and eight chapters of his fourth booke *de simplicium medicamentorum facultatibus*. *The fruites of trees* (saith hee) *that appeare to vs to be sweete when they be ripe, are soure when they are young, and ary of consistence, but in processe of time they become moyst, and their sowrnes turnes into sharpenesse, which sharpenesse they loose by degrees as they grow ripe and at length become sweete.*

An elegant place of *Galen* concerning Sapors.

Among these Sapors, Salt and Bitter are contrary to sweete, because being vnder the same kind there is the greatest distance betwixt them. *Aristotle* hauing a respect to white & blacke calleth them *priuatiues*, and that not without good cause, for although beeing vnder the

Salt and bitter are contrary to sweet

the ſame kinde they differ moſt one from another, yet they cannot bee truely ſayde to bee contraryes: for ſweetneſſe is generated in a ſubiect that is fulfilled with heate and moiſture, but ſalt and bitter are in a ſubiect which is hot yet very dry, and therefore the ſweete Sapor nouriſheth more then the reſt, yea we thinke that all other Sapors doe nouriſh onely by reaſon of their ſweetneſſe which lurketh in the ſecret bowels of the ſapide body, although by the Taſt it cannot be ſo manifeſtly perceiued. For all nouriſhment muſt bee conuerted into bloode that ſo it may become a fit nouriſhment vnto parts, but laudable and good blood is hot and moyſt and ſweete to Taſte to. That Sapor therefore vvhich hath the greateſt Analogy and affinity with bloode is fitteſt to nouriſh, and ſuch is the ſweete Taſte.

Sweet nouriſheth but no other.

Other Sapors which haue no ſweetneſſe at al in them are altogether vnfit for nouriſhment.

There are ſome which thinke that ſweete and bitter are not the extreme Sapors; grounding themſelues vpon *Plato in Timæo*, becauſe (ſay they) thoſe Sapors are to bee accounted extreames which come neereſt vnto the firſt qualities. But neyther ſweete nor bitter are ſuch, but *Styptick* or *binding* and *keene*, for the keene taſte or byting, ſuch as is in Pepper reſulteth out of a high degree of heate. The other which bindeth and contracteth the Tongue ariſeth from extreme cold.

That ſweete and bitter are not extreame Sapors. Arguments.

Againe, thoſe obiects that are extreme do hurt and offend the inſtrument; now ſweet doth not hurt but refreſheth it, yea it conſerueth the temper thereof by an acceptable pleaſure and delight. Another Reaſon may bee, why ſweete is not an extreme Taſte, becauſe from ſowre to keene the paſſage is by ſweete. So that whatſoeuer is keene or biting when it is ripe, and ſowre when it is greene, will haue a kinde of ſweeteneſſe in it before it come to his perfection. Now in qualities the tranſition is by the mediate or meane qualities not by the extreame. It is therefore to bee concluded, that not ſweete and bitter but ſowre and keene are the extreame Sapors.

But although we muſt needs confeſſe that theſe Arguments haue ſome life & ſtrength in them, yet we preſume that *Ariſtotles* opinion may well bee maintained. It is true indeede, that if you conſider Sapors according to their originall, that is, as they reſult out of the firſt qualities our aduerſaries haue concluded well. But if you regard Sapor without reſpect vnto their originall and ſimply as they are Sapours, that is, naked qualities which mooue the Taſte, then our Aduerſaries are in the wrong.

Refuted.

It may well be, that *Plato* vnderſtood the matter on this manner, becauſe he doth eſpecially attend to the temper of the body in which the Sapors are, but this is not the proper contemplation of Sapours. *Ariſtotle* who of purpoſe diſputed concerning Sapours vnderſtood them according to their proper Nature, to wit, as they mooue the Taſte for a ſweete and a bitter Sapor do mooue and affect the Senſe after the moſt contrary manner. So colours are not to be conſidered as they are nearer or further off, too or from the firſt qualities, but as they affect the Sight, and in this reſpect white and blacke are called extreame and contrary colours, becauſe they affect the ſight after a moſt contrarie manner, for white diſsipateth the Sight. *Black* congregateth and vniteth it.

Plato expounded. *Ariſtotle* defended.

Why Sapors are called extreame.

VVhereas they ſay that the keene and Stipticke Sapors do hurt the organ they are deceiued if they meane it in reſpect that they are Sapours; for the truth is, that the Offence commeth from the firſt qualities, to which thoſe Taſtes are too neere Neighbours. And this is the reaſon alſo why the paſſage is from ſowre to keen by ſweet, becauſe thoſe qualities are ſo changed in the mixt bodie, that after ſweete, ſowre doth ſucceed, & after ſowre keene or hot. Their conſequence would follow, if the ſowre Taſt ſhould engender ſweet, and ſweete ſhould engender that that is keene and hot, but there is no ſuch matter: for who did euer ſay that the ſecond qualities did ariſe one out of another? For they proceed not ſo much from their firſt qualities as from the condition of the matter. VVe conclude therefore, that becauſe the ſweete and bitter Taſtes as they are Taſtes or Sapors do after a moſt contrary manner affect the Senſe of Taſting, that therefore theſe are the extreame Sapors.

Anſwer to the ſecond reaſon

To the third.

Second quality ariſe not one from another.

Hauing thus reſolued which Sapors are extreame, let vs now a little conſider what are the intermediate, which with *Ariſtotle* we reckon ſix, *Fatt*, *Salt*, *Keene*, *Sowre*, *Sharpe* and *Tart*, which in Latine are called *Pinguis*, *Salſus*, *Acris*, *Acerbus*, *Acutus & Acidus*.

How many intermediate Sapors.

I liſt not to oppoſe *Pliny* or any man elſe that hath bene pleaſed to make more differences of Sapors, theſe are thoſe that are moſt manifeſt, and therefore Ariſtotle contented himſelfe

himselfe with them, the rest being very obscure or at least not knowne to such as this our labour shall concerne. Thus much onely we will admonish you of, that all the varietie of Tasts beside those we haue accoũted, do arise from the innumerable variety of mixtions, from the different constitutions of the orgã, as also from some secret & vnknown instincts which do recide in particular bodies, whereof to say truth we can giue no reason at all. Why they are infinite.

VVherefore becausе the Sapours themselues are infinite, their proportion very diuers, and their causes so transcendent, it is not possible to make any definition or description of them to any purpose, who can deny but that some creatures, yea some men doe vehemently desire bitter things and abhorre that which is sweete? are bitter things therefore sweete to the one and sweet things bitter to the other? You will say no, because the difference ariseth from the diuersity of his Temperament that Tastes it. I confesse it, but seeing there are almost so many diuers Temperaments as there are *indiudidua* or particular creatures in the world. I would aske the question whether it bee possible that so many different kinds of Sapours may be reckoned or deduced from them? By no meanes; no more is it possible to define them. All Sapors cannot be defined.

VVherefore if you looke into the vulgar discriptions of Sapours you shall finde them full of errours. *That* (say they) *is sweete that doth affect the Sense best, that is bitter which affects it worst.* A definition of sweet and bitter.

Neither is true, for if that which is bitter did affect the Sense worst, no man would desire it, no man woulde take pleasure in it; for that which peruerteth the harmony of the Sense, can in that respect at least bee pleasaunt vnto him, but that which doeth affect the Sense woorste must needes make the instrument to iarre, and yet wee knowe that many men (not to speake of other creatures) do wonderfully delight and vehemently long after those things which are bitter. Refuted.

Againe, if sweete were that which affecteth the Sense best, then should it please all men, yea all creatures, for that which affecteh the Sense best wee should most reioyce in, which notwithstanding we finde to be contrary often times in our selues, when nothing is more irkesome vnto vs then that which is sweete and lushious.

But some men may aske me if I do not like these definitions, how I would haue sweet and bitter defined. I answere as I a sayd before that they cannot bee defined; for accidents doe not fall vnder definition, especially second qualities which are more accidentary then the first: and therefore I thinke they cannot bee so much as described, vnlesse you will take that for a description which is most common, and when there happeneth any exception it shall be sayde (and that more truely then they are aware) that it happens by accident, that is to say, not becausе the Taste doth not agree with a discription, but becausе there is some Salt in the Organ which doth not perceiue the Sapour as it is. Obiection.

Well, wee will confesse that these Sapors being the extreames, may fall vnder some such rude discription as is before exhibited; but whose pensill can drawe so fine a line as to describe the intermediate Tastes? Shall wee make one for all, and say that those are intermediate Sapors which affect the Taste after a middle mannner? Answere.

Surely this definition had not neede to bee scanned in the Schooles, being made at random or at large without any causes or signes of causes therein.

Much better it is in my opinion to note them out by examples or instances, as *Galen* hath wisely done in the eight and ninth Chapters of his fourth Booke *de simpto. medicam. facult.* A sweet Sapour therefore doeth consist in a matter aboundantly moyst and moderatly hotte: as are Figges, Hony, ripe Grapes, sweete and mellow Apples and such like. Sapors are best declared by examples. Sweete.

The bitter Sapour recideth in a very crasse and thick matter; hot indeed but easily moyst, yea rather dry as VVormwood, Gall, Aloes and such like. Bitter.

A fat Sapor consisteth in a thin matter and ayrie, which also is temperate in the first qualities as in Seame, Marrow, Oyle, Milke, Butter & such like. Fat.

A salt Sapor consisteth in a dry matter, as in Salt, Ashes, Gunpowder and the like. Salt.

A keene Sapour is in a substance whose parts are thin and subtle, yet moyst and the temper hot; such a tast in Garlick, Onions, Raddish and the like. Keene.

A sowre tast which also they cal stipticke and *Sapor ponticus*, but I knowe not why, is in a crasse and cold matter, as in vnripe Apples & Berries or such like. Sowre.

An acute or byting Sapor is when the parts are thin, dry and hot, as Pepper and Ginger. Acute.

The sharpe is in thin parts but cold, as in Vineger, Lemons, oyle of Vitreall and such like. Sharpe.

Finally, you may with me obserue that no man for ought I know hath hitherto sufficiently described these maister Sapours, nay not so much as giuen them apt and fit names.

The confusion whereof do make the discourse of them tedious to the Reader. Onely *Galen* hath chalked out a faire way, wherein if we carefully insist, haply this labyrinth may at length be troden out. VVe conclude therefore, that if it be impossible rightlie to define these heads, hard to describe them, very difficult to giue them proper names; what an infinite taske were it to vndertake an exact discourse concerning all the particular differences of Sapors?

The confusiō of our authors about the Sapor.

QVEST. LXI. *Of the Medium or Meane of Tasting.*

The difficulty of this Quest.

WE are againe falne into a harde and intricate way wherein none of the Ancients or of the new writers haue beaten out a pathe vnto vs, and that is concerning the *medium* of Tasting. *Aristotle* was in a great suspence concerning the *medium* of Touching, neither did he determine any thing thereof. In like manner concerning this of Tasting he hath vtterly forsaken vs. And I wonder much (saith *Platentinus*) that amongst all the Philosophers there is not one that hath insisted in this disquisition to finde out the trueth; but those that haue particularlie made Tractates of this Sense haue notwithstanding balked this argument, not considering that in euery Sense there be three things especially to be stood vpon, the Obiect, the *Medium* and the Organ.

Philosophers faile therein.

Concerning the obiect and the Organ all men do agree, and the crie is vniforme and current. But for the *Mediū* there all the whole field is at a losse. Haply the difficultie of the Disquisition did affright them, for otherwise the contemplation is not vnpleasant.

Arist. toucht vpon it.

Aristotle toucht vpon it in the 101. Text of his second Booke *de anima* where he saith, That the Taste hath no externall *Medium* because it is a kinde of *Touching* which it selfe hath no such *Medium*. Beside this, he hath nothing of this matter, notwithstanding we wil aduenture to put forth our selues vnder the censure of this carping age, which if we shall not satisfie, yet

Si non datur vltra est, aliquid prodire tenus.

If further foorth we cannot go,
Yet something 'tis the way to show.

And haply he that comes after, as it is in new discoueries, may not repent him that wee haue sounded the Shore.

The taste needeth no *medium*

First therefore we enquire whether this Sense do neede a *Medium* or no. To speake ingenuously and as I thinke (saith *Placentinus*) it hath no absolute neede, neither shal it be materiall to distinguish betweene an externall and an internall *medium*, because we thinke that neither is necessary seeing the Taste which is a kinde of Touch is immediately absolued or perfected as the Touch is. That which we Taste we immediately touch with our Tongues, neither is there Sensation made till the obiect light vpon the Organe. If anie man shall imagine that there must be a *Medium*, I aske the question what he will assigne. One of the foure Elements? Or some body compounded of them? Surely neyther these nor that. For if it be an Element it must be Fire, or Aire, or Water, or Earth.

No Element can bee the *Medium*.

Not Fire

But not Fire, for that is hot and dry, which would not conserue but consume the moisture wherin especially the obiect of Taste is seated. Now the office of a *medium* is to conserue the Obiect not to destroy it.

Add heereto, that the efficient cause of Sapours is heate, but one and the same cannot be the efficient cause and *Medium* of the same thing. Againe, if Fire were the *Medium* we might like a Salamander liue in the Fire or champe burning coales and not bee hurt.

Not Ayre

The Aire is not fit for this function, for the Sapor recideth in the mixt bodie out of which it neuer yssueth, wherefore the *Medium* that must leade the Sapor vnto the Organ must also transport vnto the organ the mixt body wherein the Sapor is, but the Aire being a simple and liquid Element is not fit to carry a solid matter.

Not Water.

The VVater cannot be the *Medium*, because we do not liue in it, and therefore it is not contiguous with the Obiect and the Organ.

Not Earth.

Much lesse the Earth, for that is cold and dry, both which qualities are contrarie vnto Sapors, and therefore will rather vtterly destroy them then conserue and maintain them.

There are no pure elements

One word might haue serued all, There are no pure or simple Elements, & that which is not cannot be a *Medium*? Is it any compound body? No, for a compound body wold disturbe and hinder the Taste. Beside, euery mixt body if it haue neuer so little humidity

in

in it is of it selfe gustable, that is, the obiect not the medium of Tast. We conclude therefore that tast is made without any outward medium. Yet we doe not say that Tast is made without any intermediate Body adioyning or growing to the organ of Tast. For as in touching we haue already said in the second Booke that the scarf skin was made by nature to come betweene the obiect and the skin it selfe which was the organ, not to be a medium for that office it doth not performe, but a little to dull the quality of the obiect; so likewise in Tast which we haue often said is a kind of Touching we holde that the inembrance which inuesteth the tongue doth performe the same office to the organ, which therefore we may say is as it were a medium, though indeed and in truth it be not so. What kind of medium is necessary.

QVEST. LXII. *Of the organ of Tasting.*

HAuing thus said what we could for this present concerning the medium of Tasting, we now come vnto the organ. Concerning which there is no doubt made, all men herein beleeuing their sense that the tongue is it which discerneth the differences of Sapors. For not onely reasonable but all vnreasonable creatures, when they would taste any thing, doe lay it to their tongues: or if they cannot doe so they lay their tongues vnto it to distinguish the tast thereof. Some haue thought that the pallet is the instrument of this sense, which wee find false, because those men whose pallets are eaten out with the French disease, doe yet taste their meate well enough. It must therefore be the tongue though I am not ignorant that some haue attributed this faculty to the teeth, whose arguments happily we may answer in another place, if in the meane time we shall not thinke them vnworthy our resolution. That the palate is not the organ of Tasting. Nor the teeth.

But there are some who haue conceiued with better reason that the membrane which inuesteth the tongue is the true organ of Tasting: Among whom is *Valesius* in the foure and twentith Chapter of the second booke of his controuersies. But he affirmes it onely confirmes it not, yet because so worthy a schollar hath affirmed it, we will endeauour to make the contrary appeare. Nor the membrane of the Tongue. *Valesius* refuted.

First therefore the temperament which is common to it which other membrances doth denie it this priuiledge, for it is cold and drie, both which qualities are contrary vnto Sapors. Now the qualities of the organ must not be at daggers drawing with the qualities of the obiect, but rather friends, and liue neighbourly together, so as the organ may be potentially that which the obiect is indeed and act. The first argument.

Againe, the same membrane which incompasseth the tongue, doth also inuest the nostrills, the pallet and the gullet. If therefore the membrane were the organ, this sense should be made in all these parts, which we find by experience not to be so. *Valesius* very vnaduisedly resolueth that this very membrane incompassing the nostrills is the organ of smelling, and saith, that it is the diuersity of the temperament which maketh it in the tongue the organ of the tasting and in the nose the organ of smelling. But he is fowlly deceiued, for suppose it had in these places a different temperature, we must not thinke that onely the temper is sufficient to distinguish the organs of senses; But beside to diuers actions there is required a diuers substance; diuerse I say, and such as is not elsewhere to be found. Now this membrane although the temper doe somewhat differ in seuerall places, yet in qualities and substance it is like it selfe appearing so, both to the sight and to the touch. The second argument.

Finally that is the principall part of the instrument into which a soft nerue doth determine, but into this coate no man will say the nerue doth determine who hath but touched Anotomy with his vpper lip, yet *Galen* in the second Chap. of his 16. booke *de vsu partium* seemeth to affirme the same in these words. *As the hard nerues are inserted into the muskles, so are the soft into their proper Organ, as into the membrane of the tongue.* So that hence it might seem to follow that his membran is the proper instrument of Tasting. But this place of *Galen* is no whit against our opinion. For we thinke and confesse that that into which the nerue determines is the true organ. But *Galen* doth not say the nerue determines in the membrane, or coate of the tongue, he saith it is inserted into it; whence we may rather gather yea therefrom it is conuinced that the substance of the tongue is the organ we treat of, because into it the nerues do determine: for being inserted into the mẽbarne the extremity therof reacheth vnto the substance of the tongue to defer and confer the faculty thereunto. The third argument. Obiection out of Galen. Galen expounded. Obiection. Answer.

But it will be obiected that if this coate or membrane be ill affected the Tast is therewithall depraued. VVee yeeld it to be true, yet not because the Taste is perfected in that

part, but because this membrane concurreth to the action of Sensation, without which in deed we cannot Taste; so in the eye, if the Horny membrane bee violated the sight is then depraued: and yet it doeth not follow that the Horny membrane is the chiefe Organ of Sight. And thus we must vnderstand *Galen* in the second Chapter of his 4. Booke *de locis affectis*, where he sayth that the Taste is vitiated if the membrane of the Tongue be distempered. Or we may say that this membrane is as it were the *Taster* to the *Taste*, which office it hath partly from his own proper temperament, partly from the soft nerues which are inserted therinto, vnlesse you will say that these nerues were allowed to the membrane by Nature to giue it an exquisite sense of Touching, whereof the Tongue stood in neede for the defence of his substance, which assertion will not be against reason.

Galen expounded.

VVe conclude therefore that the membrane of the Tongue hath an exact Sense of Touching, nor altogether deuoyde of Tasting, not that it tasteth at all of it selfe but being contiguous, yea continuall and growing to the substance of the Tongue, it concurreth withall to the perfection of the action, so as without it the Sense of Tasting cannot be perfected nor accomplished.

The conclusion.

Notwithstanding, we finde another principall part to which, as this membrane, so all the other adiacent parts are substituted by Nature as helpers and handmaides, and that is the proper and spongy flesh or pulpe of the Tongue. For beside that, it hath a substance such as you can no where finde the like in the whole body, the Temperament also therof is apt and to entertaine and receiue Sapours; for it is moyst and hot neare of kinne vnto the Nature of a Sapour, that it might more easily bee altered thereby. And indeede for the making of this Sensation, it is necessary that the Organ should put on the nature of the obiect which *Aristotle* meaneth, when he sayth that the Organ must potentially be the same thing which the obiect is actually, that so it might be altered & actually receiue the nature of the obiect; for how shall it iudge of the obiect vnlesse it doe put on the qualities thereof.

That the body of the tounge is the true organ.

Arguments.

Adde hereto that it hath an ingenite humidity, that those obiects which are potentially moyste, as Salt is, being by this organ actually made moyst might become sapide, that freely and frankly exhibite his Sapours.

Againe, what greater argument can there bee, that this flesh should bee the organ of Tasting then because it is spongy, for Taste is neuer made vnlesse the moysture that carrieth the Sapour bee imbibed by the organ of Tasting, to which purpose nothing is so fit as the spongy pulpe of the Tongue. Moreouer, all the other Senses are double, and therefore Nature, though she had great reason to make the Tongue single for the commodity of the voyce, and such other circumstances as wee haue particularized in our History: yet that it might be after a sort double, she hath drawne a line through the middest whereby it is diuided into a right side and a left. On that manner there is no part in the mouth diuided, but in the mouth is the Sense of Taste, and therefore it must belong onely to the Toung.

QVEST. LXIII. *Whether the Tongue alone do Taste.*

That it may be communicated.

WEe hauce prooued that the Flesh or Pulp of the Tongue is the true instrument of Tasting. Notwithstanding it is doubted whether this Action belong onely to this part or may also be communicated vnto others. That it may be communicated to other parts: some arguments are vrged. First, the Taste is a kinde of Touching, but Touching is diffused thorough all the body. It may seeme therefore that the Taste is also diffused thorough more parts then one, especially so farre as the meate doeth attayne, that is, into the Mouth, the Gullet and Stomacke.

Againe, there yssueth out of the Braine a soft nerue which is simple and single in his originall, but when it hath paced a little forward, from the skull it is diuided into two branches: whereof one is inserted into the Tongue, the other into the lower parts.

Thirdly, we see that the Stomacke doeth reiect and cast vp some meates by vomit, other it embraceth and contayneth.

In like manner the Gullet swallowes some meates well and freely, others not without loathing and much difficulty, yea some meates because of the enmity betwixt the stomack and their Taste, euen after they are downe are cast vp againe.

It may therefore be demaunded how this choyce can bee made, this loathing or liking stirred vp, vnlesse we say that the Stomacke and the Gullet do Tast and distinguish the differences of Sapors.

Adde

Add hereto the authority of *Ariſtotle*, who in the 11 chapter of his fourth Booke *De partibus animalium* ſaith, that Fiſhes in their ſwallowing do take pleaſure and haue a ſenſe of the meate that paſſeth into their Mawes. Without doubt theſe arguments are not to be contemned, and yet we will make anſwere vnto them.

To the firſt we ſay, that though the Taſte be a kinde of Touch, yet it is not neceſſary that it ſhould in all conditions anſwere or be proportionable to the Touch. Anſwer to the firſt.

To the ſecond, that although the Nerue which is inſerted into the tongue do tranſmit another branch to the Gullet and the Stomacke, yet it doth not follow that the gullet and the ſtomacke muſt taſte, for the ſoft nerues do tranſport the faculty of ſenſation; yet that the Eye ſees colours, the Eare heares ſounds, the Noſe perceiues odours or ſauours, is not by reaſon of the Nerue, but becauſe of the diſpoſition and temperament of the organs. For the faculty of ſenſation is euery where one and the ſame, neither is there any difference in the faculty whereby wee heare, nor in the faculty whereby wee ſmell, from the faculty whereby wee taſte; but all the difference ariſeth from the diſpoſition of the organ. The Foote would ſee, and the Elbow would heare, and the ſides would ſmel, and the crowne would Taſt, if in theſe parts there wer a diſpoſition to receiue the obiects of theſe Senſes. To the ſecond. The differences of the ſenſes depend on the diuerſitie of the organs.

In like manner, although the Gullet and the Stomack do receiue a ſoft Nerue, yet the Gullet and the Stomacke do not Taſte becauſe they are not diſpoſed thereto. But the Reaſon why Nature hath giuen them this ſoft Nerue wee may finde in *Galens* 2 chapter of his 16. Booke *de vſu partium*, to wit, becauſe they ſtood in neede of an exactneſſe of ſenſation. Now (ſaith *Galen*) thoſe parts which had need of exact Senſe, haue all of them receyued ſoft Nerues.

From this that hath bene ſaide, we may ſhape anſwers vnto the reſt of the arguments. That the Gullet ſwallowes ſome meates, and loaths others: that the Stomacke reteines ſome meates and caſts vp others, wee aſcribe vnto the pleaſure or paine which they feele from the tactile qualities: for of the parts of the body of man none hath the Senſe of touching ſo exquiſite as the Stomacke. For beſide that it is membranous it hath an infinite number of branches of Nerues inſerted thereinto, that it is no wonder if it kicke againſt the leaſt offence. So if we thruſt our fingers into our throats wee can procure a Vomit, not that wee make our Stomacke loath any thing, but becauſe the Tactile qualities doe vrge and prouoke a ſenſible part. VVee alſo may ſay, that becauſe of the contiguity of parts the Stomacke is fore-warned by the Tongue, ſo that the Tongue perceiuing anie horrid or vnpleaſant ſauour communicateth the Senſation to the ſtomacke, forewarning it of an approaching enemy which thereupon ſtirring vp it ſelfe as it were to battell, yerketh againſt it and calleth it forth. And to ſay true, there is ſuch an inſtinct in Nature bred and ſetled in thoſe parts. For wee may not attribute the ſenſe of Taſting to the Gullet or Stomacke, becauſe if theſe partes had Taſte, the ſicke man that takes a pill or Bole wrapt vp in Sugar wuold neuer retaine it, which if he take without Sugar hee preſently caſts vp again: and the reaſon is, becauſe when they are not rowled in Sugar or otherwiſe made ſweete, their bitter or vnpleaſant Sapor is perceyued by the Tongue, & warning thereof giuen to the Stomacke. They are reteyned being ſweetened becauſe that ill Taſte is obſcured and ſo the Tongue deceyued. Being now arriued into the Gullet or the Stomack, although the Sugar melt from them yet they are not caſt vp againe, becauſe the ſtomack doth not perceiue their Sapor. And this is the reaſon why when we would let down any vnſauoury thing into the ſtomacke we endeuour not to touch the Tongue more then of neceſsity, leaſt it ſhould be prouoked thereby. VVee conclude therefore, that neyther the Gullet nor the Stomacke do perceyue Taſts or Sapors but onely the Tongue. To the third. Why the ſtomack caſts vp ſome meat & reteins other. Another anſwere to the argument. Of the ſwallowing of Pils

QVEST. LXIII. *In what part of the Tongue the Taſte is moſt exacte.*

HAuing found out the Organe of Taſting, it remaineth in the laſt place to ſearch in what part of the Tongue the ſenſe is moſt exacte, for there is no queſtion but there is a great difference.

There are ſome reaſons to perſwade vs that the backpart of the toung doth taſte better then the forepart. First, becauſe at the back-part of the Tongue the Almonds are ſeated on either ſide which doe receiue the ſpittle and a great quantity of moyſture: wherefore becauſe the ſpittle doth helpe this ſenſe very much, it is That the back part taſteth beſt.

to be imagined that where there is moſt ſpittle there is beſt Taſting. Againe, the Nerues which are inſerted into the backſide of the Tongue are greater then thoſe which are inſerted into the foreſide. Yet *Ariſtotle* holdeth the contrary and prooues his part better, for what can be more certaine then experience.

The contrarie opinion. *Ariſtotle.* Reaſons

If therefore we deſire to Taſte any thing more curiouſly we apply it to the tip of our tongues, and if it fall toward the roote we call it backe againe. Againe, when wee are to ſwallow any thing whoſe taſte is diſpleaſing to vs we haſten it to the roots of our tongue as ſoone as we can. The reaſon is, becauſe the ſenſe of Taſting is not there ſo exquiſite. Moreouer, it is very reaſonable that the Taſte ſhould be more perfect in the fore-part, becauſe this ſenſe was allowed to the creature to diſcerne hurtfull Taſts and to auoid them. But if the perfection of the Taſte had beene at the rootes, that which is offenſiue might haue ſlipped downe before we were aware, whereas the tippe of the Tongue diſcerning the difference beſt, is alſo beſt able to free it ſelfe from that wherewith it is offended. Add heereto, that the forepart of the Tongue is ſofter, more ſpongie and better diſpoſed to imbibe the humidity wherein the Sapor is conteined.

VVe conclude therefore, that the perfection of the Taſte is not in the rootes but in the tip of the Tongue.

Anſwer to the former arguments.

The arguments that were brought to prooue the contrary may eaſily bee anſwered. For becauſe there is ſo great a plenty of moiſture at the roots of the Tongue, therfore the beſt Taſte ſhould not be there: for ſuperfluous humidity doth not quicken the Taſte but dulles it.

Neither do we deny but that the Nerue is larger at the roote of the Tongue, but it doth not follow that therefore the Taſte is there more perfect, becauſe in the fore-part though the Nerues be leſſe, yet they be more plentifull and aboundant, and therefore do cauſe the Taſte to be more perfect.

And thus we are come vnto an end of theſe Labyrinths concerning the Senſes, wherein we haue beene ſomewhat the more prolixe, that thoſe which loue the contemplatiue part of Philoſophy might haue ſomething wherewith to pleaſe their appetites. It is true indeede that there are many paſſages in theſe Controuerſies, which for the moſt part we haue taken out of *Iulius Caſſerius Placentinus* which might wel haue befitted the Schooles themſelues, but wee imagine that theſe our Labours may happily fall into ſome mens hands who will be willing to recognize thoſe Studies which for better employments they haue intermitted. A very few of which kinde if I ſhall giue contentment vnto, I vvill not thinke my labour ill beſtowed. Other men vvho do not vnderſtand them, or elſe are better able then my ſelfe to ſatisfie themſelues, may turne ouer to that vvhich ſhall be more fitting for their Diſpoſitions. And ſo we will leaue the Head and Senſes, and come vnto the Ioynts.

The End of the Eight Booke of the Senſes, and the *Controuerſies thereunto belonging.*

THE NINTH BOOKE,

Wherein the Ioyntes are briefely *Described.*

The Præface.

IN the whole body of Man there is nothing more wonderfull then the ſtructure and poſition of the Ioynts, nor any thing wherein a man doth ſo much differ from all other creatures. The bowels are moſt what a like in all, both for Nutrition, Generation Life and Senſe, becauſe all creatures haue like vſe of all thoſe parts as well reaſonable as vnreaſonable. The onely thing which makes the difference is the Reaſonable Soule which is inuiſible, a Nature tranſcendent and aboue the Nature of the body. But the faſhion and poſition of the Ioynts whereby the body is lifted vp from the earth, vppon which the other creatures doe grouell, maketh the greateſt difference betweene man and beaſt. It were a world of wonder to enter into diſcourſe of the particular Reaſons of this poſition, and wee haue partly handled them before in the firſt Booke, bnt eſpecially wee purpoſe to proſecute them in the ninth Booke deſtined to that purpoſe.

Galen hath taken eſpeciall paines in this argument appropriating therunto his three firſt Bookes *de vſu partium*, wherein he hath preuented any man that ſhould take paines after him. Wee ſhall thinke wee haue quit our ſelues well if we can in ſome ſort abbreuiate thoſe large Volumes in this place, wherein we haue laboured ſo much the more to be as conciſe as the ſubiect matter will giue vs leaue, becauſe all the particulars will fall vnder our diſcourſe in our bookes of the Muſcles the Veſſels and the Bones. The Reader therefore is to be intreated to content himſelfe with this bare ouerture, where in wee will but muſter the parts cloſe together, becauſe we ſhall haue time and ſcope to draw out our troopes and to marſhiall them in better order when we come into the large fields of the Bookes which follow.

CHAP.

CHAP. I. *A breefe description of the Ioynts.*

WEe before deuided the body of Man into three Regions or Venters, and the outward parts or the Ioynts. Through the three Regions, Naturall, Vitall & Animal, we haue carried our Story with as great breuity and perspicuity as we could, it followeth now that we prosecute our History vnto the Limmes. The Ioints therfore which grow vnto the body as boughes vnto the trunke of the tree are called in Greeke κῶλα and γύια, in Latine *artus ab artando*, in English wee will call them Limmes or Ioynts, because there are most ioynts in them.

2 kinds of ioynts.

There are therefore two kinds of Ioynts, the vpper and the lower; the vpper ioyntes are called by the common name of the *Hand*, for the Ancients accoũted the whole member from the shoulder to the fingers ends to bee all the *Hand*. The lower Ioynts as likewise called *Pedes*, that is, the Feete, of which we shall speake afterward. The whole Hand *Hippocrates* and *Galen* doe deuide into three parts in *Brachium*, *Cubitum*, and *Summâ* or *extremâ manum*, that is, the Arme, the Cubit and the Hand as we call it.

The diuision of the hand

The arme.

The Arme *Celsus* calleth *humerus*, *Festus* calleth it *Armus*, whence our word came. The Head which is inserted into the broade bone or blade of the shoulder is called by *Pollux* ἀκρωμία, by *Euripides* ἐπωμὶς, the end is called ἀκρωλένιον.

The cauity vnder the ioynt of the shoulder *Aristotle* calleth *axilla*, commonly *ala*, because in it do grow hayres as feathers in a wing which is called *ala*, and we call it the armehole.

The Cubite

The second or middle part is called in Greeke πῆχυς or ἀγκών, in Latine *Cubitus* or *Vlna*, we will call it the Cubite to distinguish it from the vpper part which we call the Arme.

The hand.

The third part is called *Manus*, from *manare* to flow, because it floweth as it were out of the Cubit: this we call properly the Hand, and it hath three parts, the wrest called *brachiale*, the After-wrest called *post-brachiale*, and the fingers called *digiti*, of which wee shall speake in their due place. And this is the common diuision of this ioynt. VVee now will follow the particular parts of the diuision.

CHAP. II. *Of the parts of this Ioynt in generall.*

The veines of the whole hand.

THE proper parts of the whole Hand taking it in the large acception of the Ancients, are beside the common parts which we pretermit, the Vessels, the Muscles and the Bones. By the Vessels I vnderstand the Veines, the Arteries and the Nerues. The Veines which are deriued through this whole member doe arise all from the Axillary branch: and there are two; the first passeth along on the inside, the other on the out side of the arme. That on the inside is called *Basilica*, that on the out side is called *Cephalica*. The *Basilica Hippocrates* calleth *Venam internam* the inward veine, Others call it *Hepatica* & *Iecoraria*, that is, the Liuer-veine. And it is ordinarily deuided into a deeper and a shallower. The deeper climing ouer the axillary Artery and the third paire of sinnewes passeth along to the bought of the Arme which we commonly call the Elbow, and so bestoweth his branches vpon both the bones of the Cubite.

Basilica.

The Liuer veine.

Mediana.

The shallower runneth vnder the skinne to the ioyning of the Cubite with the Arme where it is clouen into two boughes, one of which passeth to the inside of the Cubite, and there is vnited with a branch of the humerary veine, and from that coniunction ariseth the *Common veine* which they commonly call *Mediana* or the middle veine; the Arabians cal it the *blacke veine*. The other bough descendeth along the lower side of the Cubite sprinkling the skinne and partes by which it passeth with diuers small branches.

The blacke veine.

Cephalica or the head vein

The *Cephalica* or Head-veine so called, because it is opened in diseases of the Head; *Hippocrates* calleth *externa* or the outward veine, because it creepeth along the outside of the arme: others call it *Humeraria*, (because it passeth thorough the shoulder betwixt the Muscle called *Deltoides* & the Tẽdon or chord of the Pectoral muscle) which falling down vnder the surface of the skin, when it commeth vnto the bought of the Cubite is diuided into two branches: the one borne along obliquely into the inside of the Cubite coupleth it selfe with the braunch of the Liuer-veine, and betwixt them beget the common or middle veine; the other which is larger descendeth by the *Radius* almost to the middest there-

of

of and hence running oblikely to the wriſt, it watereth almoſt all the backe of the hand, and endeth in a notable and manifeſt branch, betwixt the little and the ring fingers: where it is called *ſalua tella*, and is opened, as authors ſay, with good ſucceſſe in ſpleniticke perſons. *Salua tella.*

The arteries which belong to this hand doe proceede in one bough from the axillary artery, and this bough is called *Baſilica*. It hath two branches one ſetled deepely, the other eminent betweene the skin and the fleſh. Both of them doe affoord many deriuations out of themſelues, but that of the ſhallower is moſt notable which is often times to be ſeene in the inſide of the wriſt a little aboue the roote of the thumbe, at which place and by which artery we vſe to feele the pulſe to find out the differences thereof. The arteries of the hand. The pulſe.

And for ſinewes there are ſix paire diſſeminated through the whole hand, the firſt commeth out of the firſt racke bone of the necke and is ſpent in the Deltoides muſkle and the skin neere vnto it. The ſecond ariſing from the ſixt racke bone of the necke firſt paſſeth into the double headed muſkle; then it caſteth of a ſmall branch to the long muſkle of the Cubit, and at length when it attaineth to the elbow it is diuided into branches. The third being mingled with the ſecond, reacheth his helpe to the muſkle of the arme, which lieth vnder that with a double head. The fourth which is the largeſt of all the reſt falling vnto the ſame muſkle together with the deepe liuer-vaine and the inward artery is deuided into diuers branches The fift paſſeth along betwixt the muſkles, which bend and extend the cubit and hauing gotten ouer behind the inward proceſſe of the arme, and being mixed with the third coniugatiõ, is conſumed in the fingers, giuing to the little finger two nerues, to the ring finger likewiſe two and to the middle finger one. The ſixt pa re ſliding downe betweene the skin & the neruous membrane by the inward proceſſe of the arme determineth into the skin of the Cubit And theſe are the veſſels of the whole hand whoſe deſcription we ſhall more exactly ſet downe in a fitter place hereafter. The muſkles of the whole hand are very many, ſome moue the Arme, ſome the Cubit ſome the Radius, ſome the wriſt and ſome the fingers, of which alſo we ſhall ſpeake in their proper place. The bones of the hand are diuers, the arme hath one bone, the *cubite* two, the *wriſt* eight, the *after-wreſt* fower, the fingers fifteene, to which we may adde if we pleaſe the ſmall ſeede bones called *Seſamoidea* all which we will as curiouſly and accurately as we are able deſcribe in our booke of the bones, whether at this time we refer the reader. Six paire of ſinewes of the hand. The firſt. The ſecond. The third. The fourth. The fift. The ſixt. The muſcles of the hand. The bones of the hand.

CHAP. III. *Of the excellency of the hands.*

MAn, who is the crowne and pride of Nature, that bold and confident worke-Miſtriſſe, him I ſay, God on his birth day, did caſt out vpon the duſt of the earth, naked, vnarmed, and weltring in his bloud, to enioy or rather to deplore an inheritance of ſorrow and miſery. Yet notwithſtanding becauſe he is ſent into the world to be a combetant and not a ſluggard, he hath armed him with two wondrous weapons, which he hath denied to all other liuing creatures, Reaſon and the Hand. His reaſon is the ſtorehouſe of all arts and ſciences, the firſt ground-worke and foundation of whatſoeuer the immortall ſoule is naturally capeable or apprehenſiue of; an arte it is, as before all arts, ſo hath it all arts for his ſubiect or matter whereabout it is occupied. The hand is an inſtrument, but as it is the firſt inſtrument ſo it is the framer, yea and imployer of all other inſtruments. For not being framed for any one particular vſe it was capeable of all: ſo as it may iuſtly be compared to the ſoule, which as the Philoſopher ſaith is, though not in deed yet in power and ability all things. By the helpe of the hand Lawes are written, Temples built for the ſeruice of the maker, Ships, houſes, inſtruments, and all kind of weapons are formed. I liſt not to ſtand vpon the nice skill of painting, drawing, caruing, and ſuch like right noble Artes, whereby many of the Ancients haue made their names honorable vnto vs, yea and eternized them to the worlds end. By our hands we promiſe, we call, we diſmiſſe, we threaten, we intreate, we abhorre, we feare, yea and by our hands we can aske a queſtion. By the helpe of the hand although a man be borne vnarmed, yet is he able to ſafegard himſelfe from all other creatures: and all thoſe creatures which come ſtrong and armed at point into the world, how fierce ſoeuer they be, how able to abide the violence of heauen it ſelfe, yet are they not ſafe from the hands of men. For doth not the induſtry of mens hands preuaile againſt the hornes of the Bull, the teeth of the Lyon, and the paw of the Beare, yea whatſoeuer is comprehended vnder the cope of heauen, by the skill of the hand is brought vnder our ſubiection and made tributary vnto vs. Man is the glory of Natures workemanſhip. The weapons which man hath more then other creatures. What a man can doe with his hand.

And

Anaxogoras. And therefore *Anaxagoras* as *Plutarch* reporteth, marking diligently the curious fabrick of the hands, the postures of the fingers, as they moue either together or apart, the mighty strength, the cleane nimblenesse and the soft delicacy thereof, ascribed vnto them the cause and originall of mans wisedome. How much wiser was *Galen* who in those melodious Hymnes which he wrote to the praise of his Creator, I meane his Bookes of the Vse of Parts discoursing very curiously concerning this curious instrument concluderh, That man is not therefore the wisest of all creatures because he hath Hands, but because hee is the wisest of all creatures, therfore Nature furnished him with this excellent instrument. It was not the Hand that taught men Arts but Reason, yet the seruant and minister of this reason and wisedome is the Hand: they are the Vicars or Substitutes and Suffraganes of the speech, the interpreters of the secret Language of our silent conceits, signifying to all men in a few Letters as it were by Hieroglyphicks what the very thoughts of our Hearres are.

Galen.

The Handes consecrated to Faith.

Numa Pompilius consecrated the Hands to *Faith*, and therefore all Compacts, Couenants, Truces & enter-courses whatsoeuer are held inuiolably ratified by the very touch of the Hand, and at this day in our neighbor-countries the Principall Nobility do sweare their allegiance into the Handes of their Prince or his Substitute.

That very Touch was also among the *Persians*, the most sacred pledge of fidelity: and therefore the most Ancient did vse to salute one another on this manner, giuing and receyuing honor by this part. Likewise they which adore Princes or great Potentates are accustomed to kisse their Hand and incline their head. In the Egyptian Hieroglyphicks the Hand was the Embleme of Fortitude, and therefore they which seeke for helpe doe call for the right hand, for so it is in our common Prouerbe, *Lend mee your helping Hand*. I list not to commend the Hand from that superstitious Art or Imposture, rather of such as call themselues *Chyromantickes*, whose idle speculations are not fit to bee mingled with our serious discourse, which we will now transferre from the excellency and commendation of so curious an Instrument to a more Anatomicall consideration of the Vse, Figure and Structure of the same.

The Hands Emblemes of Fortitude.

The vanity of Chyromãticks.

CHAP. IIII. *Of the Vse, Figure and Structure of the Hand, properlie so called.*

The seuerall vses of the Hand.

THE true office of the Hand is to apprehend or to holde, and his proper action is apprehension (for *Hand* and *Holde* are Coniugates as we term them in Schooles) from whence it is called *Organum ἁπτικὸν*. The First vse therefore of the Hand is to take hold. Another vse of it is to bee the iudge and discerner of the Touch. For albeit this touching vertue or tactiue quality be diffused through the whole body both within and without, as being the foundation of the Animall *Being*, which may be called *Animality*, yet we do more curiouslie and exquisitely feele and discerne both the first and second qualities which strike the Sense in the Hand then in other parts. It is also an Instrument well fitted to ease our paynes, to propulse or driue backe iniuries and to defend the fore-parts of the body. Wherefore for these vses and for the performance of all his functions it hath that figure which we see, and that admirable structure which as well as we can we shall vnfold vnto you. The Figure is long and diuided into many parts that it might comprehend in one all kinde of Figures, the round or Spherick, the right and the hollow, for all figures are made of three lines, a crooked, a hollow, and a straight. Beside, this figure doth equally apprehend both greater bodies and lesse; for small things it holdeth with the ends of two fingers, the great finger or the thumbe and the forefinger.

The hand the instrument of touching.

The figure of the Hande.

If the body bee a little bigger, it conteyneth it with the same fingers but not with the ends. If it be yet bigger, we vse three fingers, the thumbe, the fore and the middle fingers. If it be larger then we can containe with three we vse foure, and so fiue, and at length the whole hand. Now if the Hand had bene made of one continuall peece, it would onelie haue apprehended a body of one magnitude. Neyther was it sufficient that the Hande should be diuided into fingers, vnlesse the same fingers had beene placed in a diuers order and not in the same right line, so as one was to be set or opposed to the other four, which beeing bowed with a small flection might meete and agree with the action of the other foure opposite vnto it. And this is the manner and proportion of the figure. For the structure if it be diligently attended, it will imprint in vs an admiration of the wonderfull skill

Why diuided.

The structure of the Hand.

and

and workemonship of Nature and it is on this manner. Because the Hand was the most noble and perfect organ or instrument of the body: God the Creator moulded it vp of diuers particles, all which for our better vnderstanding we will referre vnto foure kindes.

The first kinde is of those which originally and by themselues doe performe an action: the secõd of those without which an action is not performed: the third of such as do more perfectly accomplish an action, and the last of such particles as do preserue an action.

The principall part of the hand is the muscle.

The first and principall part of the hand is a Muscle, because there is no apprehension without motion; now wee know that a Muscle is the immediate organ of voluntary motion.

The second part without which there is no apprehension is a Nerue; for the Muscle moueth not vnlesse it be commaunded, this commandement the nerue bringeth together with a subtle spirit, and therefore it is called *Lator* or the poast.

The bones & nailes doe make the action perfect.

The third which accomplish the Action are the Bones and the Nayles: the Bones doe make the action strong and stable, without which the Fingers might indeede be extended and bent againe, but because of their softnesse they would euer haue beene trembling, and not able to haue holden any thing straight or firmely.

The Nayles further apprehension. The particles which do preserue the Action are the Veines, the Arteries, the Skinne and the Fat. The Veines water it with bloud; the Arteries quicken it with vitall spirits; the Skinne and the Fat make a *Colligation* or tying together of all the rest.

CHAP. V. *Wherein is declared the reason of the framing of all the similar parts whereof the Hand is compounded.*

Why the fingers haue little flesh.

THe Muscle therefore is the principall part of the Hand by which immediatly apprehension is made. But because there are two especiall partes of a Muscle, the Flesh and the Tendon or Chord, Nature placed many Tendons and little Flesh vpon the Fingers, because the end of the Hand should be light & thinne, not heauy and thicke.

The tendons of the fingers.

These Tendons from their originall euen to their insertion are round, that they might bee lesse subiect to outward affects, but in the very insertion they growe broader that the motion may be more nimble. But because there are many motions of the fingers, to wit, right, as Simple; flection or extention; & oblique whē they are brought together or parted a sunder; it was necessary that there should be Tendons both without and within and on the sides of the fingers. But how many Muscles there bee of the hand, whence euery one of them ariseth and where they are inserted together with their structure, we shall declare in the next Booke, wherein wee handle of sette purpose the Historie of all the Muscles.

Their nerues.

Nerues they haue dispersed into their Muscles and Flesh, and those very many from the fourth and fift payre of the Arme which yeelde vnto them the faculties of Sense and Motion.

Their bones.

The Bones of the Hand are eight of the Wrest, foure of the After-wrest which are tyed together with a strict and immouable articulation or iuncture. The Bones of the Fingers are ioyned by *Diarthrosis*, for it behooued that they should so moue as they might be able to apprehend or take hold of all figures or fashions of things. These Bones are onely three neither more nor lesse, for more would haue hindered perfect extention, and fewer would not haue admitted so many and diuers particular figures. And all these that the motion might bee more facile and easie, are knit together by *Ginglymos*. Nowe the variety of the motions is furthered both by the gristle which compasseth their extreamities, and by the fatte and oylie humour which like a slime doth line the ioynts. But because when the creature according to his pleasure shall bend and bow these ioynts, they should not be disseuered or fall out of their seates; Nature hath knitte them together with tyes and bands, and wedged them in also with small bones like *Sesamum* seedes. For these small bones which are in the inner ioynts of the Hand doe not suffer the ioynts to *Luxe* or shoote inward, when we streatch out our hands strongly; and those that are placed in the outward ioyntes keepe them from leaping outward when wee bend our handes with violence.

The ties or bands.

The seede bones and their vse.

The further discourse of the Bones of the Hand you shall find hereafter in the last Book which is of the Bones: for to transcribe euery particular here, were to abuse my owne time and your patience.

The

The bones therefore doe make the action more perfect. For if the fingers were without them, we should be able to performe those actions only wherein it behoued vs to draw the fingers into a circular forme. The Nayles also were made to further the vse of the Hand; for hard and small bodies would easily flie from the fingers, vnlesse there had beene set to their ends a hard body, both to strengthen and establish the flesh, as also to keepe in and retaine such small and slipery things. Finally the veines, arteries, skin, and fat, doe preserue or conserue the action.

The vse of the nailes.

CHAP. VI. *Of the distincter parts of the hand, of the Wrest and of the After-wrest.*

THe Hand properly so called, hath three dissimilar parts: the Wrest, the After-wrest, and the Fingers. The Wrest called *Carpus*, the Latines more vsually call *Brachiale*, the Arabians *Raseta* or *Roseta*, because it was a custome to adorne that part with roses, and diuers flowers. It consisteth of eight bones set in two rankes, which haue no proper names belonging vnto them. The After-wrest called by the Latines *post-brachiale* and by *Celsus Palma*, is deuided into two parts, the internall and the externall: the internall part which makes the hand hollow when it is stretched foorth, hath his name in *Hippocrates* from a word which signifieth a stroke, because with the palme we vse to strike. The Latines call it properly *Palma*, and so doe we the Palme of the hand: whichwnen it is crooked & hollowed is called *vola manus*. The outward part which is the backe of the hand is called *manus auersa* or *dorsum manus*. In the Palme of the hand there are many particles obserued. For the beginning of it which riseth a little toward the inside of the wrist is called *Radix manus* the roote of the hand. The middle part is called *Interstitium* or the partition. The fleshy swellings which the Chyromanticks call hyllockes or Monticles do make the brawne or pulpe of the hand and are called properly θέναρα of a word which signifieth to smite. That hillocke which is vnder the thumbe is called *mons martis*, that vnder the fourth finger, *mons Iouis*, that vnder the middle finger, *Saturni*, that vnder the Ring finger *Solis*, that vnder the little finger is dedicated to *Venus*. The *Thenar* that is the space which is betwixt the thumbe and the forefinger is called the hill of *Mercurie*: and the *Hypothenar* which is the brawne betweene the roote of the thumbe and the little finger is called the *Moone hill*. Beside these, there are also in the *Vola* or cup of the hand many lynes, by the sight and obseruation whereof, the Chiromantickes doe promise and take vpon them, to foretell the length or shortnesse of the life, good or euill fortune, Naturall inclinations, and in a word the euents of all accidents: with how great reason or from what cause or ground either in Nature or in Diuinity, *ipsi viderit*: we will onely for distinction sake, and because it is rather lookt for at our hands then that we approue any such impostures, name them vnto you. They are said to be fourteene, but three are principall: the first which compasseth in the thumbe is called *Vitafera* the lyne of life by others *temporalis*, or the lyne of Tyme. The second which runnes ouerthwart through the middest of the *Vola* or Cup is stretched to the moone hill, and is called *iliaca* the Lyuer lyne or the Naturall lyne. The third beginneth from the *Hypothinar* or moone hill, and reacheth to the mount of *Iupiter* and is called the table or bed lyne of *Venus*.

The wrist.

The after-wrist.

The palme.

The backe of the hand.

The hillockes of the hand.

The Lines.

The line of life.

The naturall Line.

The table line or line of Venus.

When the hand is shut it is called *Pugnus*, or the fist; when it is halfe bent it is called *condylus*. Further we must obserue that Nature hath made two hands, one to helpe and assist the other, the right and the left. Some there be which can as well vse this as that, and are called *Ambidextri*. A woman saith *Hipocrates* cannot be an ambidexter, that is she cannot vse both hands alike.

Why two hands.

CHAP. VII. *Of the Fingers of the Hand.*

THe last part of the hand containes the Fingers, called *digiti*, whose order and ranke is called *Phallaux*; the internall articulations or ioynts; are called *internodia*, the knots of the fingers. The fingers ends which are round and fleshy are called *Vuia* or the grapes. The outer part of the fingers haue knubbie or knotty ioynts called in Latine *Nodi*, we call them knuckles, and there are three in euery finger. Each hand hath fiue fingers, neither more nor lesse, that the apprehension might be more perfect. For take away the thumbe, and you take away the power and strength of all the rest: if you take away the little finger you canot incompasse anything circular

The parts of the fingers.

Why fiue fingers and no more.

cularly- Now theſe fingers vvere made vnequall in length and magnitude that wee might the better comprehend all figures and all quantities both greater and leſſe. The firſt, becauſe in ſtrength it is equipolent or equiualent to al the reſt is called *pollex* or the Thumb and hath onely two ioynts. And this finger hath peculiar muſcles, bending, extending and leading it too and fro, becauſe it hath ſomething peculiar in his motions. The ſecond is called *Index* from his vſe, becauſe we vſe it when we would ſhew any thing. *Suetonius* calleth it *Salutaris*, it hath a Greeke name alſo from a word which ſignifieth to licke, becauſe with it we vſe to taſte or licke any thing. The third is called *Medius* or *Famoſus* the middle from his ſituation, *Famoſus* becauſe by ſtretching this finger foorth we vſe to deride or diſgrace when we liſt.

The Thumbe

The forfinger

The middle-finger.

The Ring finger.

The fourth is called *Medicus*, becauſe therewith in old time they vſed to mingle or ſtir medicines; tis alſo called *Annularis* or the ring-finger, becauſe the Ringes are there moſt commonly worne. The fift, becauſe it is the leaſt is called *Minimus*, and *Auricularis* becauſe with it we picke our eares. Euery finger hath three bones ioyned by *Ginglymos*, as we ſhall ſay heereafter. Finally, for more ſteddy apprehenſion there are nailes ſet vnto the Fingers ends engendred of the more craſſe and thicke excrements of the third concoction, and therefore they grow continually only in length as do the haires. But their growth is not by nouriſhment but by an imperfect acruing of the matter, for there is no traction or aſsimulation of aliment, but onely an appoſition of excrement.

The little finger,

The nature of the Nailes.

They are moderately hard that they might not be hurt with outward things ruſhing againſt them and alſo round fot their further ſecurity: the Latines call them *Vngues*, their roote which is like a white moon is called *Radix* or *Ortus*: the tops which we pare off *Extremitas*, the white ſpottes in the Naile *Mendacia*, ſo many ſpots ſo many lyes. And this ſhal ſuffice for the deſcription of the vpper Ioynts, now follow the lower.

The partes of the Nailes.

CHAP. VIII. *Of the Foote in Generall, his Excellencie, Figure, Structure and Vſe.*

AS man alone, becauſe he was the wiſeſt creature had Hands giuen vnto him the firſt and originall Inſtruments of the world, ſo he alone of all creatures which dwell vpon the earth and vſe feete onely, hath two feete anſwereable to his two hands; for if he ſtood groueling on foure ſtiltes, how could hee ride, write, build, throw a weapon, or exerciſe any of thoſe Arts wherewith he is furniſhed. The Figure and poſture of bruite beaſts had beene altogether vnprofitable and incommodious for this diuine creature, for neither could he haue looked vppe to heauen, for which cauſe euen *Anaxagoras* could ſay that he was created; nor ſit him down to meditate, for they ſay, that *the ſitting ſoule is the wiſeſt*, neither could he paſſe through ſharpe vnequall or ſloping places, climbe Turrets, builde houſes, or any ſuch thing. It is true, that the more feete the ſwifter is the creature (other things being equall,) but what neede had man of ſuch footemanſhip to ouertake, when by his induſtry hee is able to circumuent all other creatures? He was therefore made *Bipes* that is, with two feet, & therefore he ſtandeth vpright or ſitteth at his pleaſure.

Why a man hath but two feete.

The proper vſe of the foote is to walke and the action is walking, and therefore the foot is called *Inſtrumentum ambulatorium* or a walking Inſtrument. This walking is vvhen one Legge reſteth vpon the ground, and the other is brought about forward. The reſting is the action of the foote properly ſo called: the reach forwarde the action of the legge: and therefore ſeeing ambulation is made by ſtation and motion, that is, ſtanding & proceeding, the foote it ſelfe is the inſtrument of the former, and the whole legge of the latter.

The Office of the Foote.

How ambulation is made.

Now for aſſured and conſtant or firme ſtation, as alſo for the accompliſhment of thoſe many motions whereof we ſtand in neede, the ſtructure and figure of the foot and legge is ſuch as we ſee. For it is diuided into diuers ioynts, and the toes are made long & broad not ſo long as in the Hands, but only as was neceſſary to faſten the feete when we would ſtriue to run. For if the Toes be preſſed vnto the ground, it is ſtraunge with howe much ſtrength and ſecurity the body is driuen forward.

The figure of the Foote.

Moreouer, the feete were made hollow in the midſt that they might better paſſe thorough all places: for the hollow ſoal encompaſſeth that which is round or gibbous wheron we tread, and the Toes do hold vs faſt in right, oblique, ſloping and aſcending progreſsions. There is a great ſimilitude betwixt the feete and the hands, ſo as wee haue ſeene ſome who had no hands, to do all the offices of the hands with the feete.

The likeneſſe betwixte the Feet and the Hands.

CHAP. IX. *The similer parts of the Foote in the large acception.*

ALl that by the ancients is called the Foote which reacheth from the hip ioynt euen to the end of the Toes. It may be diuided into similar and dissimilar parts. The similar parts as in the hand so here are containing or contained; containing, as the scarfe-skin, the true skin, the fat, and the fleshy membrane. The parts contained are the vessells, the flesh and the bones. The vessels are of three sorts, veines, arteries, and sinewes. The vaines doe all deriue their pedegree from the Crurall branch. This crurall branch shooteth out of himselfe many sprayes through the thigh, the leg and the feete, deuided into many twigs. Six of them are among the rest most conspicuous and are called by these names. *Saphena*, *Ischias minor*, *Muscula*, *Poplitea*, *Suralis*, and *Ischia maior*. The *Saphena* or anckle vaine arising from the kernells in the groine passeth downe on the inside of the thigh betwixt the skin and the fleshy membrane, and reacheth ouer to the outward anckle and is after diuersly consumed or spent into the skin of the top of the foote. The lesser *Ischias* opposite to the *Saphena* is distributed into the fore skinne of the hippe and the muscles of that part. The muscula is diuided into two branches, the lesse of which watereth the muscles which extend or stretch foorth the legs. The greater lies deepe in the flesh, and is diuersified almost into all the muscles of the thigh.

The similar parts of the foote.
The veines of the foote.
Saphena.
The lesser Ischias
Muscula.

The *Poplitea* is made of two branches of the crurall vaine ioyning together, and after it hath sent some small sciences into the backe skin of the thigh it falleth downe through the middest of the hand, and is sometimes spent into the skin of the calfe, sometime it passeth to the very heele, and sometime turneth aside vnto the outward anckle.

The Popletea

The Surall vaine is disseminated into the muscles of the *Sura* or calfe, and vnto the skin which is on the inside of the leg: and being reflected about the inner anckle, it attaineth vnto the inside of the foote, and the skin of the great toe very rarely to any of the other toes. The greater *Ischias* hath two parts, one greater which passing through the muscles of the calf spendeth it selfe into ten shoots allowing two to each toe. The lesser which endeth betwixt the Perone and the heele sometimes preforating the ligament in the middest is dispersed into the muscle which draweth the toe backward and into the skin. The crurall artery brancheth it selfe like the vaine, so that euery vaine hath an artery accompaniyng it. The nerues which are disseminated through the whole leg are fowre and those very notable, which arise from the three lower paires of the loynes, and from the fowre vpper of the holy or great bone. The first and the vppermost falling vnder the Peretoneum to the little Trochanter is consumed into the muscles of the thigh, and into the skin, both on the out and on the inside, before it touch the knee. The second and the lower, descendeth through the left together with the crural veine and artery into the thigh, and sendeth a notable branch to accompany the anckle vaine through the inside of the thigh, euen vnto the foot, in the meane time bestowing small tendrills vnto the neighbor skin but the greater part of it together with the vaine and artery is dispersed into the inner muscles of the thigh. The third lower then the former dispersеth his fauours to the muscles of the yard, and to some of the muscles also of the thigh, not forgetting the skin of the lesk, and afterward it determineth in the neighbour muscles aboue the middle of the thigh. The fourth which is the thickest, driest and strongest of all the nerues hauing his originall from the fowre vpper spondells of the *Os sacrum* or the holy bone, gliding along betwixt it and the hanche bone, affordeth certaine branches vnto the neighbor parts, as vnto the skin of the buttockes and of the thighe, and to the muscles contained vnder them. Afterward departing into two branches, the lesser falleth by the *Perene* and giueth two shootes vnto each toe, the greater stretching along the leg and the foote, giueth likewise two branches to each toe, but both these boughs by the way as they passe doe touch, at the heads of the muscles and at the skin of the leg, and the foote, and doe tye them together. And this shall serue for a short description of the vessells.

The Surall
The greater Ischias.
The arteries of the foote.
The 4 nerues of the whole foote.

The muscles of the feete. The bones of the feete.

The muscles of the feete are diuers: some Bend the thigh, Extend it, bring it to the body lead it from the body and turne it about: others doe moue the leg with the selfe same kinds of motions, others bend and extend the foote it selfe. Finally, there are others, which moue the toes of the feete, the particular history of all which you may require in the next booke of the muscles. The bones of the feete are very many: one of the thigh, two of the leg,

legge called *perone* and *Tibia*, together with the whirle-bone of the Knee: the wreſt of the feete called *pedium* hath ſeauen bones: the after-wreſt called *Metapedium* hath fiue, and there be 14 of the Toes to which may be added ſeed-bones like to thoſe which we found in the hand. Of all which we will giue you ſatisfaction in our Booke of the Bones.

CHAP. X. *An explication of the diſsimilar parts of the whole foote.*

THE great foote is diuided as the hand into three diſsimilar parts, the *Femur* or Thigh, the *Tibia* or Legge, and the *pes* or Foot. The Thigh is called *Femur aferendo*, becauſe the creature is therewith ſuſtained or held vppe. The fleſhy parts are called by *Hippocrates* πλησίασις, the fore-partes παραμήρια. The Pulpie or fleſhy part about the ioynt belowe is (on the backeſide into which the Knee is bent) called *Poples* the Ham, becauſe it is folded *Posſ*, that is, backward: the fore-parte is called *Genu*, that is, the Knee. The ſecond part of the foote from the Knee to the Heele is called κνήμη or σκέλος, in Latine *Tibia*, we call it the Leg: the forepart whereof *Antetibiale* the Shinne, the hinder and fleſhy part *Sura* the Calfe: the two proceſſes without fleſh neere the bottome *Maleoli* or the Ancles. The laſt part of the foote is called *pes paruus* & properly the Foote, becauſe it is the baſis or pediſtall wherupon the whole body reſteth and it is the true organ or Inſtrument of progreſsion: & as the hand is diuided into three parts, the Wreſt, the After-wreſt and the Toes. The Wreſt is called *pedium*, and conſiſteth of ſeuen bones, foure of which haue proper names, the other three none. The forepart of this *pedium* is called the inſtep. The backe part is round and is called *Calx* or the Heele, the lower part of it is called *Calcaneum*, becauſe with it wee do *calcare Terram* tread vpon the Earth, and we call it the pitch of the heele.

The partes of the foote in the large acceptation.

The ſecond part of the foote conſiſteth of fiue bones and anſwereth to the After-wreſt of the hand, in Latine it is called *Tarſus*, the lower part of it is called the plant or the ſoale of the foote, the vpper part betwixt the Inſtep and the Toes is called *pectus* or *dorſum pedis* the breſt or backe of the foote. Finally, the Toes are fiue anſwering to the fingers of the Hand, and haue their owne orders, making three ranks called ἀκροφαλάγγες, excepting the great toe. Theſe bones are ioyned by *Ginglymos*, and haue ſeede-bones for theyr firmer articulation: for theſe ſmall bones make the foote ſtronger when we ſtand ſtil or walk on; eſpecially if our way be through ſharpe places, where otherwiſe the toes might eaſilie be luxed if they could be turned backe with ſtones or any other higher or vnequall ſubſtance whereupon we ſhould tread.

The Vſe of the ſeed-bons in the foote.

And this is the true and ſuccinct deſcription of the Ioynts, wherewith wee deſire the Reader to reſt contented at this time, becauſe he ſhall finde a more accurate delineation of all the parts of them in their ſeuerall places in the Tractes following, beginning with the moſt compounded parts, and ſo proceeding till wee come vnto the moſt Simple and Similar.

The End of the Ninth Booke of the Ioynts.

THE TENTH BOOKE,

Of Flesh, that is, of the Muscles, the Bovvels *and the Glandules.*

The Præface.

AS our ability, time & auocatiõs haue giuen vs leaue, we haue gone through our first diuision of the body of Man into the three Regions, Naturall, Vitall and Animall and the Ioynts. It remayneth now that we dissolue euery one of these into those parts whereof they are compounded, laying each apart by themselues that their Natures and differences may better appeare. In this *Analysis* or Resolution wee will first begin with the *Flesh*, which beside that it maketh the greatest part of the bulk of the Body, is also somewhat more compounded then the rest of the Similar parts. Next wee will entreat of the Vessels, that is to say, of the Veines, Arteries and Sinewes; for these are the Riuers or Brookes which conuay the Bloud, the Spirits, the Heate, the Life, the Motion and the Sense, into all the parts and corners of this Little world. Afterward we will descend vnto the Gristles, Ligaments, Membranes and Fibres: Parts, not onely Spermaticall and Similar, but also Simple, that is not Organicall. Last of all wee will come vnto the Bones, that is, to the foundation of this goodly Structure; the Pedestall or Columns vpon which the frame of the body of Man is reared and whereby it is strengthened and supported. I know well that some Anatomistes of the best note, haue in their deliuery of this Art quite inuerted this order which we haue proposed vnto our selues, beginning first with the Bones, and so ascending by the Gristles, Ligaments, Membranes, Vessels and Flesh, vnto the three Regions and the Ioynts: which Methode being *Geneticall*, we conceiue to be rather the way of Nature then of Art; for Nature first lineth out of the masse of Seede, the warp of the body, and after with the woofe filleth vp the empty distances: first she layeth the foundation, rayseth the stories, bindeth the ioyntes and plastereth the walles, till it come vnto a perfect building. Art on the contrary takes it asunder peece and peece, proceeding from that which is more to that which is lesse compounded, till at length it come vnto the very ground-worke or foundation. This Method we haue followed till we are come vnto the Flesh: Of which there are three kindes; one of the Muscles, another of the Bowels, and the third of the Glandules. To the declaration of these three we haue destined this Booke, but begin with the Muscles, because they are more compounded then the rest.

CHAP.

CHAP. I.

What Flesh is, and how manie sorts of Flesh there bee.

FLesh in Latine *Caro*, in Greeke σάρξ, hath diuers acceptions amongst the Ancients. Sometime in a strict and proper acceptation it is taken for the flesh of a Muscle, as if a Muscle and Flesh wer both one thing: so *Hippocrates* vnderstandeth it in the 16 Aphorisme of the fift Section where he saith, *That bathes of hot Water will loosen the Flesh*, that is, dissolue the strength of a Muscle: in the second Section of his Book *de Fracturis* he calleth the Muscles absolutely flesh, because their cheese part is flesh. But most plainly of all in his Booke *de Arte*, where he saith, *All those members which are compassed about with flesh, which flesh they call a Muscle, all those parts I say haue bellies.*

The diuers acceptations of Flesh.

Flesh and a Muscle al one.

Sometime by flesh we vnderstand that simple part which is peculiar and proper to ech part of a mans body, and compasseth, gathereth together, and couereth the *Stamina* or fibres defending them against the rage of the naturall heate which would consume & depopulate their very substance, as also against the heate and colde, and other outward occurrents.

The particular Flesh of euery part.

Concerning this flesh *Hippocrates* in his Booke *de Ossium Natura* hath this saying, *The Flesh is that which tyeth together and buildeth or reareth vp all the parts of this frame*. VVee out of *Galen* and the late VVriters doe take knowledge of foure distinct differences of Flesh; one is flesh properly so called, another is the flesh of the bowelles, the thirde is the peculiar flesh of euery part, and the fourth the flesh of the Glandules or Kernelles.

4. Kinds of Flesh.

The flesh properly so called is a soft and ruddy part made of blood moderately dried, & is therefore called a bloody part and a hot part: such is the flesh of the Muscles which is truly and absolutely called Flesh, such is also the flesh of the Gums and that in the nut of the yard.

What is flesh properly so called.

The flesh of the bowels *Erasistratus* calleth *parenchyma*, as it were an affusion or gathering together of blood. For he thought that the substance of the bowels did accrue or gather of blood yssuing out of the Veines. But wee thinke that the bowelles haue a proper substance of their owne which is the principall and chiefe part of the bowell to which his action doth properly belong. There is also another flesh peculiar vnto euery solide part, which flesh hath no proper name, but *Galen* calleth it *Carnosam substantiam*, the Fleshye substance: for in the tenth Booke of his Method he acknowledgeth a double substance in the solid parts, the one exquisitely solide and fibrous altogether without blood, another which stuffeth the fibres and filleth vp their distances, and is called the proper flesh of euery part: this he thinketh is neuer restored if it be lost but only moistned and cherished when it is present. Such is the flesh which is to be seene in the stomacke, the Guttes, the Gullet, the Bladders and the wombe. And such a kinde of flesh *Theophrastus* attributeth vnto plants growing about their woody, and as it were sinnowy fibres.

The flesh of the solid parts

A twofolde substance of the solid parts

The common vses of this three-fold flesh *Galen* hath described in his twelfth Booke *De vsu partium*, to wit, that it should defend the partes from heate and colde and other outward occurrences. For all flesh is a soft pillowe for the creature when it either lyeth or falleth downe; when it is wounded it yeeldeth to the hardnesse of the weapon; when it is bruised or beaten it filleth vp the breach as it were a boulster of Lint: in the sweltering heate of the Sunne it serueth for a shadow, and in the violence of cold it keepeth warme. And these vses I haue called *Common*, because there are other peculiar to each kinde of flesh: for the flesh of the Muscles both mooueth voluntarily and also by his stuffing it hindreth the Chord or Tendon of the Muscle, least when it is contracted or drawne together it should depart from the bodye, as also it easeth and moisteneth the drowth of the Nerues and Ligaments, which they continuallie acquire by theyr perpetuall motion.

The common vses of Flesh.

The particular vses of the flesh.

The flesh of the bowelles as it were a certaine stuffing or concretion, first confirmeth the vessels of the bowels, next it filleth vp the empty places betwixt the vessels; and lastly it performeth a similer and officiall action as we shall say anon. Finally there is a glandulus flesh such is the Pancreas a kernally body placed in the belly neere to the gate of the liuer: for some haue defined a Glandule to be a masse of flesh rowled vp in it selfe. And these in my iudgement are all the differences and distinctions of flesh. The particular hi-

The Flesh of the Glandules

The order of this booke.

ſtory whereof, we wil as accurately and briefly as we may deſcribe vnto you in this following diſcourſe, beginning with the fleſh of the muſcles, as being a more compound and organicall part, and ſo proceeding to that of the bowells and glandules, which are more ſimple and ſimilar, originally deriued from the firſt conformation of the body.

CHAP. II. *Of the fleſh of the Muſcles, and what a Muſcle is.*

THe firſt and chiefe kind of fleſh, is that of the Muſcle, in the deſcription whereof becauſe of the variety and difficulty of the ſubiect, we muſt craue a little leaue ſomewhat to inlarge our ſelues. For it is far and wide ſpred ouer the whole body, and maketh indeed the greater part thereof. This is that which giueth ſtrength, proportion, and beauty to all the other parts, whereof if the body be diſpoiled, as it happeneth in the melting and diſſoluing heate of a hecticke ague, there remaineth nothing elſe but the image of a dead creature, nay of a dried and parched carkaſſe: which may ſeeme to be the reaſon that moued *Hipocrates* to call his booke wherein he treateth of the principles of the body and the nature of the particular parts (a worke which he compoſed in his olde age, as appeareth by the experienced certainty, maieſty and weight of the ſentences therein contained) *de carnibus* a booke of fleſh. The fleſh therefore when it is gathered together on a heape *Hipocrates* calleth a Muſcle in his booke *de arte* as we haue ſaide before, and againe the muſcles he calleth abſolutely Fleſh, becauſe the principall part of them is the fleſh. And in his prognoſtickes from the laudable and commendable habit or proportion of this muſculous fleſh he gathereth the perfect health of the whole body. And in the fourth Section of his Aphoriſmes and the ſixteenth, when he would deſcribe a haile bodie, he maketh mention onely of this fleſh, where hee ſayeth, *Ellebor is dangerous to ſuch as haue ſound fleſh*, that is, ſuch as are in perfect health. For the muſcles are a kinde of of part both gouerning and being gouerned: they gouerne thoſe members for whoſe motion they were ordayned, and are gouerned by the Brain through the Nerues, by the Heart through the Arteries, and by the Liuer through the Veines: wherefore if theſe be in good plight (which is eaſie to be knowne by the naturall figure, freſh and flowry colour, and their iuſt and due extent) they ſhow that the principall parts are in a good and commendable conſtitution. The Nature therefore, differences and actions of theſe Muſcles we haue taken for our preſent taske; wherein how fairely ſoeuer we ſhal acquite our ſelues, yet wee make account as in all other parts of this labour, ſo eſpecially herein, by reaſon of the difficulty to finde the trueth and diuerſity of mens opinions; we ſhall expoſe our ſelues to manifould cenſure and exception, vnleſſe wee light vppon the more equall Auditors. But to the matter.

Hippocrates conueteth the names of fleſh & muſcles.

Wherein the laudable habit of a muſcle conſiſteth

The names of a muſcle.

A Muſcle is called in Greeke μῦς, that is, a *Mouſe*, either becauſe it is like vnto a fleyne Mouſe, or vnto the Fiſh which they call *Muſculus*. It hath alſo diuers Latine names, one from the Greeke, which is, *Muſculus*, and that we will incorporate or infranchiſe into our Engliſh, although the next Latine name, which is, *Lacertus*, in Engliſh a Brawne, might reaſonably wel be retained, had not vſe made this other more common. For we call an Arme full of ſound fleſh, a *brawny Arme*: but to hold the name of Muſcle.

A double conſideration of a muſcle.

There is a double conſideration to be had of a Muſcle; the firſt is, of the ſtructure or compoſition of it, the other of the office and vſe: and therefore there may be a double definition giuen of it.

If you regard the ſtructure, it is defined by *Galen* in *arte parua*. *A fleſh wouen of ſimple fleſh and ſimilar fibres*. And in the Booke of Phiſicall definitions it is called *A ſinowey body mingled with fleſh*. It may more fully be defined thus: *It is an organicall and diſſimilar part wrought together of Nerues, Fleſh, Fibres, Veines and Arteries, all couered or inueſted with a proper coate of his own.*

That a muſcle is an organ.

That it is Organicall, *Galen* teacheth in his Booke *de differentijs morborum*, in which place he reckoneth it amongſt thoſe Organs which are moſt ſimple and of the *firſt kinde*, becauſe it is not made of diſſimilar particles but of ſimple.

That it is Diſſimilar, the ſtructure of the parts being of diuers kindes doe euidently proue. The Nerues are the conuayers of the ſpirites and the faculties; the fleſh ſtuffeth the diſtances betweene the fibres that they ſhould not be mingled, tempereth the drynes of the Nerues and Tendons, preſerueth the threds or fibres that they bee not bruiſed or broken, and maketh the Animall ſpirites more apt to mooue by his heate. The Fibres which are wouen of ſmall particles of the ligaments diuerſly diſheueled doe ſtrengthen

The partes of a muſcle and their vſe.

the

the flesh, establish and preserue it that it bee not dissolued: the veines like small riuerets are prouided onely for nutrition; the Arteries doe conserue the heate; the Coate inuesteth the Muscle, contayneth his substance, separateth and distinguisheth it from the adioyning parts and giueth it the sence of feeling. This is the structure of a muscle *according to them all*, to *them alone* and *at all times*.

There is another definition of a Muscle taken from his office which *Galen* deliuereth in his first Booke *de motu musculorum*. *A muscle*, sayeth hee, *is the instrument of that motion which is performed with violence*, or a *Muscle is the immediate organ of voluntary motion*. By violence *Galen* vnderstandeth that which *Aristotle* calleth *Spontaneum*, or voluntary which proceedeth from an inward principle, to wit, from a desiring or mouing faculty. *Galen* calleth that which is Voluntary often times Animall to distinguish it from that which is Naturall: and in his Booke *de tremor: palp.* he calleth Muscles Organs which are moued at our discretion.

The explication of the definition.

Now that motion is Voluntary which at pleasure we can appease, and againe excite or stirre vp when it is appeased, and make it swifter or slower, rarer or quicker as wee list.

This will or pleasure of man is double; one from Election, another from Instinct: the first we exercise when we are awake, the latter when we are asleepe or minde some other matter more. The first is a streatching or Tention not without strife or contention: the second is in remission or rather the remission it selfe of that contention or strife; & therfore they that are a sleepe do neyther moue their bodies into extreame & violent figures or postures, neither doe they accomplish the perfect *Tonica l* motion, that is, the stedfast holding of the member, as those that are awake.

What is voluntary motion

A double will from election and from instinct.

Of this Voluntary motion there are diuers instruments, the Braine, a Sinew and a Muscle, but one is immediate. The Brayne commandeth, the Sinew or Nerue carrieth the commaundement, and the Muscle obeyeth. The Brayne determineth of the obiect which is to be desired, whether it be profitable or noctious and hurtfull, to be followed or auoided: from hence therefore is the beginning and originall of the motion. When the action is agreed vpon by the Brayne, the Nerue which is the spirits vehicle carrieth down the faculty of mouing: the Muscle being illustrated or enlightned with the beames of the spirit is presently contracted and immediately moueth the part according to the diuersity of the commandement which it receiueth from the will. And as a horseman hauing the reynes in his hand dryueth forward or reyneth in the horse, so the fantasticke power of the Soule sitting in the Braine, by the Nerues as by a reyne or brydle moueth the muscles.

Three organs of motion.

How these 3. doe worke.

An apt comparison from a man on horseback.

These things therefore are necessarily required to locall and voluntary motion, which in order doe follow one another. *An obiect appetible* or to be desired, *The faculty desiring*, and *a power to moue locally* The Brayne, the Animall spirites, the Nerues and the Muscles.

Wee conclude therefore that a muscle is the immediate instrument of voluntary or willing motion, whatsoeuer can be obiected against the trueth of this definition shall be heard, and receiue satisfaction in our discourse of the Controuersies annexed to this Booke.

CHAP. III. *How many and what are the parts of a Muscle.*

THe parts of a Muscle we will distinguish into similar of which the whole body of the Muscle is composed; and disimilar into which the same body according to his length is deuided.

The parts of a muscle.

The similar parts are Nerues, Fibres, Tendons or Chords, Flesh, Veines and Arteries. The disimilar are three, the beginning, the middle, and the end; or the *Head*, the *Belly*, and the *Taile*. Out of these similar partes ioyned together and diuersly intangled with an admirable arte, resulteth an organ ordained for voluntary motion. But in this composition there is not the like worth or vse of all the particles, neither doe they meete together in the same degree or efficacy of operation.

Wherefore as before in euery perfect organ we obserued foure kindes of partes; the first of those by which the action is made originally and essentially; and to these *Galen* attributeth the preheminence or superiority: the second of those without which the action goeth not forward; the third by which it is better performed; the last of those which doe conserue the action or keepe it as wee say in tune: so all these foure differences of partes

In all organs 4. kinds of parts are to be obserued.

a

The fleſh is the principall part of the muſcle.

a diligent Anatomiſt may obſerue in a muſcle. The fibrous-fleſh is the prime and principall part of a muſcle, and as *Hippocrates* and *Galen* doe beleeue the proper ſubſtance of the ſame: for if you reuiew the whole body you ſhall finde none like it; when that is wanting or decayed the motion alſo is weake or none at all, and where it is there alſo is alwayes voluntary motion: this onely is prepared and fitted by Nature to receiue the influence of the *mouing quality*: this alone doth eaſily collect, contract and gather vp it ſelfe together, and looſneth and remitteth the part which it hath drawne: ſo alſo the chiefe part of all the bowels is ſayd to be their fleſh or *parenchyma*.

The tendons make the action more perfect.

The Nerues which are diuerſly diſperſed into the Muſcles, are thoſe without which the motion cannot be: for they are the conuayers of the Animall ſpirits, and bring down from the throne or tribunall of the Soule, which is the Braine, the warrant and commandement to mooue: which if they bee cut, obſtructed, refrigerated, inflamed, or any other way affected, the motion periſheth inſtantly. The Ligaments and Tendons doe make the action more perfect; for the Tendon is not as we ſay in Schooles *ſimpliciter*, that is, originally and by it ſelfe ordayned for motion, but *ſecundum quid*, that is, for the performance only of vehement, ſtrong and continuall motions, and therefore there be very many Muſcles without Tendons.

Hippocrates.

The Veines, the Arteries, and the Membranes, are they which conſerue the action; for the Veines and Arteries doe reſtore the waſting and decaying ſubſtaunce of the Muſcles, which by reaſon of continuall expence are waſhey and fleeting: and therefore they are in great aboudance diſperſed through the fleſh, becauſe as *Hippocrates* ſayth *Fleſh is a drawer*, and the bloud ought to be in greater quantity then the reſt of the humors becauſe the mountenance of the Muſcle ariſeth thereby. The Membrane as it were a garment or couering inueſteth and cloſeth the Muſcle and giueth it the ſence of feeling. And thus much concerning the Nature of the ſimilar parts of which the Muſcle is formed.

3 diſſimilar parts of a muſcle.

Now the whole body of the Muſcle is deuided into three diſsimular parts, the *Head*, the *Belly* and the *Taile*.

The Head,

The Head is moſt commonly neruous, ſometimes but rarely flecty: for it is made of Ligaments ariſing from the bone, yet is it not altogether inſenſible becauſe of the inſertion and interpoſition of the ſinewes, for it is couered with a peculiar membrane.

The Belly.

The Belly is the middle part of the Muſcle almoſt all fleſhy, and maketh the bulke of the ſame: and for that reaſon in the Legge they call the pulpe, that is, the brawne of the Calfe wherein the middeſt of all the Muſcles of that part doe ſo meete that they ſeeme to make but one Muſcle, they call it I ſay γαστροκνημίαν as it were *the belly of the Legge*, wee call it the Calfe.

The Taile, whereof the tendon is made.

The laſt part of the Muſcle is the End, the Taile or the Tendon, it is called ἀπονεύρωσις, becauſe it is almoſt altogether neruous. *Galen* thinketh that the Tendon is framed of the fibres of the nerues and Ligaments confounded and mingled together, yet ſo that there are more fibres or ſtrings of the Ligaments then of the Nerues, whence it is that the tendon is ſixe yea ten fould thicker then a nerue.

The reaſon of the compoſition.

And the reaſon of this mixture is becauſe the ligament of it ſelfe and by his own Nature immooueable and inſenſible, could not alone performe a voluntary motion: and againe the nerue becauſe of his ſoftneſſe and ſlight or thinne texture was not able to draw the vaſt bulke or magnitude of the members: and therefore it behoued to make of them both a mixt organ which ſhould be harder and ſtiffer then the nerue for ſtrength, and ſofter and more pliable then the Ligament for motion: and ſuch is a Tendon partaking of the Nature of them both, ſo becomming of a middle diſpoſition betweene them; more ſenſible and weaker then a ligament, ſtronger and leſſe ſenſible then a nerue.

Furthermore, we muſt remember that all muſcles haue not Tendons or Chords, as the Muſcles of the Tongue, the Teſticles, the Lippes, the Fore-head, the Yarde and the 2. Sphincters: but onely thoſe which are mooued either ſtrongly, or vehemently, or continually. Thoſe that are ordayned for the motion of bodies doe alwayes end and determine into Tendons either greater or leſſe, and are inſerted not into the iuncture or very ioynt of the bones, nor into the ends of that bone from which they ariſe, but for the moſt part into the head of the bone which is to be mooued wrapping it about. The Muſcles alſo which moue continually though their motion bee neither ſtrong nor vehement, yet they ſtand in neede of a Tendon: and therefore the muſcles of the eyes are not without them.

Why the ſmall muſcles of the eies haue tendons.

CHAP.

CHAP. IIII. *What is the action of a Muſcle, and the differences of the motions thereof.*

A Muſcle as it is an Animall Organ hath one and but one action to wit, Motion: the Nature of which Motion is not obuious or eaſily knowne of all. *Galen* in the eight Chapter of his firſt Booke *de motu muſculorum* acknowledgeth foure differences of motions in theſe wordes: *The Muſcles are eyther contracted or extended, or ſinke of themſelues, or elſe remaine ſtreatched or diſtended.* There are 4. motions of the muſcles.

Contraction is the proper and ingenit action of the Muſcle; for whileſt it moueth any part whether it houldeth it ſtedfaſt when it is bent, or bendeth it being before ſtretched or diſtended, it is alwaies contracted or drawne vnto his owne originall, that is, towards his head. Now that contraction is the proper action of euery muſcle, hence it appeareth that if the muſcle bee cut a two in the middeſt ouerthwart his body, you ſhall ſee the one part contracted vpward and the other part contracted downwards.

The ſecond motion of the Muſcle is Extention, which is not proper but aduentitious or accidentall: for when the contracted Muſcle is extended it is looſened by another and not by it ſelfe: and therefore almoſt euery muſcle hath ioyned vnto him a companion, nay rather an *Emulus Concurrent* or aduerſary, becauſe it is the author of a motion contrary to his: As for example, euery *flexor* or bending muſcle hath a *tenſor* or extending muſcle; euery *adductor*, that is, which moueth *toward* hath an *abductor* which moueth *froward*; euery *leuator* or lifting muſcle hath a *depreſſor* or ſinking muſcle. VVhen as therfore a muſcle which is contracted is alſo extended, in this extention it followeth the motion of his *Antagoniſt* or Aduerſary, ſo that the extētion is not the proper motion of the muſcle that was contracted, but rather his paſſion then his action. Extention the 2. motion of the Muſcle. Note this.

There is a third motion of a Muſcle which is yet more improper, in which it is neither contracted nor relaxed but falleth with his own weight, and this is called *tranſlation* or *decidence* and ſinking: this motion is not from the Soule but from the Elementary fourme, for the part not illuſtrated with the beames of the Animall ſpirite falleth with his owne weight, and ſo the part is moued the mouing faculty being at reſt. So *Galen* ſayth that the *tremor* or trembling, which the common people cal the ſhaking Palſey, commeth to paſſe by an equal contention or ſtrife betweene the mouing facultie and the moued member; for the faculty lifteth the member vp, and the waight of the member ſinketh it ſelfe again, and ſo from that viciſſitude or enterchange of lifting vp and falling down commeth the trembling. How trembling commeth,

The laſt motion of the Muſcle we call *Tonicall*, wherein the fibres of the Muſcles are ſtreatched and ſo remaine; ſo that the part ſeemeth indeed to bee immouable but yet in trueth is really moued. This motion is moſt euident in Birds when they flye or glide in the ayre with their wings ſtiffe ſtreatched and ſeeming immouable; a man alſo ſtandeth by this motion, and ſo a Piſmire moueth vpward vpon a ſtaffe as faſt as the ſtaffe deſcendeth downward. The laſt motion which is Tonicall. Examples of Tonicall motion.

Of this motion *Galen* ſpeaketh when hee ſayeth, that euen in ſleepe the Muſcles doe moue. There are therefore in all foure motions of the Muſcles, two performed by themſelues, and thoſe are contraction and the conſeruation of that which is contracted which ſecond motion is that we cal *Tonicall*: for ſuch is the Nature of ſucceſſiues or ſucceeding motions, that they are no leſſe accompliſhed when they are conſerued then when they are firſt made. 2. motions *per ſe*.

The two other contrary to the former are by accident, to wit, Extention and Decidenſe; Contraction, Extention and the Tonical motion haue ſometimes extream ſometimes middle figures or poſtures. All extreame poſitions are painefull, thoſe that are meane are eaſie or pleaſant: the extreame wee cannot long endure vnleſſe wee bend our minde and power vnto it: the meane we eaſily endure when wee thinke not of it. And therefore whileſt we ſleepe we very rarely ſuffer any extreame flections or extentions of the Muſcles, and then onely when the fancy worketh exceeding ſtrongly: otherwiſe the Muſcles are inclined rather then bent to either ſide, as *Hippocrates* obſerueth in *Prognoſtico*: *They lye* (ſayth hee) *when they ſleepe with their Thighes, Handes and Feete moderately reflected or inclined, becauſe at that time the ſtrength of the Animall actions is not ceaſed but only abated.* 2. other *per accidens*.

Men

Men also in their sleepe haue not so strong Tonnical motions as when they are awake, as we may perceiue in the sphincter muscles which shut vp the waies of the excrements, which perfourme indeede their Tonnicall motion in a good sound sleepe, but if the violence of the excrement be great they either cease their motion and so the excrement auoydeth, or else the faculty being distressed calleth for more helpe, and so the party awaketh and becommeth more able to hould his owne. But it is worthy obseruation that all muscles when they moue are crooked, and when they rest are stretcht: and the reason is, because being contracted they become broader and shorter, and longer when they are relaxed: but from this generall rule, the muscles of the Abdomen & the *Intercostall* muscles or those betweene the ribbes are to be exempted, for when they are relaxed and the contention remitted they grow crooked, which I thinke happeneth by reason of the laxe and yeilding emptinesse of the chest and the lower belly.

What the figure of the muscle is when it worketh & when it playeth.

CHAP. V. *Wherein all the differences of Muscles are showne.*

All the differences of muscles. The first.

THE Muscles doe differ among themselues in their substance, quantity, figure, site, originall, insertion, fibres, parts, vse and action. If you consider the substance, some are fleshy all ouer as the sphincters and muscles of the tongue: others are almost all neruous or membranous, as that *abducter* or fro-ward muscle of the Legge which is called *Membranosus* or *fascia lata*, the broad Rowler.

The second, The quantity considereth the dimensions; now dimension is threefould. Length, and hence some Muscles are long, as the right muscles of the *abdomen* and the *abductor* of the Legge, and some short. Bredth and hence some are broad as the oblique and transuerse muscles of the *abdomen*, and the broade muscle which beareth down the arme, and others narrow: the last dimension is altitude whence some are thicke, as the two large muscles called *Vasti*, and some are thinne or slender; so much for the quantity.

The third, The figures of the Muscles are manifould, some like a Mouse, some like a Snake, some like a Plaice. Againe, some are triangle, some quadrangle, some fiue cornerd, some pyramidall or spiry, and some orbicular or round. To this kinde we may referre the Muscles called *Deltoides*, *Rhemboides*, *Scalenus*, *Trapezius* and such like.

The fourth. From the situation, the diuision or difference of Muscles is very elegant: this site wee consider in the position of the fibres and in the differences of place: from the position or tract of the fibres some muscles are right, some oblique and some transuerse. The oblique are are most fitte for oblique or side motions, the right for more exact flexion or extention.

The differences of the place according to the length doe make the muscles higher or lower: according to the breadth, right and left: according to the height, forward, backeward, internall and external. Those occupy the inside which bend the part and those the out side which doe extend it: and so much for the site.

The fift. In respect of the originall some arise from Bones, and these now from their heads of extuberations when they behoued to be greater; now a little lower or from the cauities; sometimes from one bone sometimes from more; others from Gristles, as the proper muscles of the *Larynx* or throttle; others from a membrane incompassing the Tendons or Chords, as those which are called *Vermiculares* or the wormy muscles; others from other parts, as the sphincters.

The sixt. The difference from the insertion is; that some are inserted into a bone, some into a Gristle, as those of the throttle and the eye-lids; others into a membrane, as those which moue the eye; others into the skinne, as those of the lippes; others into other bodies: some also there are which hauing distinct originals doe yet end and determine into one part: and some againe hauing but one originall are inserted into diuers parts. And so much of the insertion.

The seuenth. Now if you marke the texture of the Fibres, they are of one kinde almost in all Muscles: and yet there want not some which haue two or three kinde of fibres manifestly appearing in them, as that which is called *Pectoralis* and *Trapezius*, as also the Muscles of the Lippes, from whence come their diuers and different motions.

The eight. The eight difference of Muscles, is from the diuersitie of three parts; now by parts in this place I meane both the especiall parts of the Muscle it selfe, and those parts or places wherein such Muscles are seated. The parts of the Muscles are three as we haue sayd, the

Head

Head the Belly and the Tayle. Moſt Muſcles haue but one Head, ſome two, and ſome three, from whence there are called *Bicipites* and *Tricipites*. The Belly ſometimes is one and ſometimes two as in the Muſcle which ſhutteth the lower Iaw and that of the bone *Hyois* which is at the roote of the Tongue, which Muſcles from their double bellies are called *Digaſtrici*. The Tendon is in ſome broade and membranous, in others round, in ſome ſhort, in others long, in ſome perforated, in others there is none at all, in others but one, and in others many Tendons: ſometimes alſo you ſhall perceiue diuers Muſcles to determine into one Tendon; as in the leg of the *Twins* & the *Soale* is made one Chord or Tendon.

From the parts in which the Muſcles are ſeated they haue alſo names to diſtinguiſh them from others, as *Crotaphitæ* or temporall Muſcles, *Rachitæ* or *Spinati*, that is, *Thorny* Muſcles, and *Iliaci*, that is, Muſcles of the *Ilia* or *Flankes*. Finally the moſt neceſſary difference of Muſcles, as I thinke, is taken from their vſe and action. The action of a Muſcle is voluntary motion: therefore according to the variety of their actions ſhall be the differences of the Muſcles; which I am wont to referre to three eſpeciall ones. The firſt ſhall be this. Muſcles are either of a kinde red, or of an aduerſe faction. I call thoſe akin which do conſpire and agree into one and the ſame worke, as the two *Flexors*, and the two *extenſors*, the one of which vſeth to occupie the right, the other the left ſide. Thoſe of the aduerſe faction are called *Antagoniſts* oppoſites or Concurrents, which performe actions contrary or ſucceeding one to another. For euery Muſcle almoſt hath ſet vnto him another, whoſe action is contrary to his as to a *flexor* is ſet a *tenſor*, to a *leuator* is ſet a *depreſſor* to an *adductor* is ſet an *abductor* onely we muſt except the two *ſpinCters*, and the *Cremaſters* or hanging Muſcles.

Of the place.

The 2. from their vſe and action.

From the variety of action three differences.

What muſcles are a kinne.

What are Antagoniſts.

Thoſe that are a kinne are almoſt alwayes alike in magnitude number and ſtrength, but the oppoſites are not alwayes ſo equall, but vary much according to the weight of the part which is to be mooued, or the vehemency of the action. So they are but two which bow the head, but to ſtretch it out and lift it vp there are twelue. Againe, there are many which cloſe the neather Iaw, and but onely two that open it: for heauy things or parts do eaſily fall with their owne weight.

Of theſe Muſcles which are of a kinne *Galen* hath left this rule. *As often as thoſe muſcles which are of a kinne are in oppoſite parts equall in number, magnitude and ſtrength, the reſolution of one makes the conuulſion of the other.* And of the oppoſites or *Antagoniſts* he writeth thus in his firſt booke *de motu Muſculorum*. *Of thoſe motions that ſucceed one another if one periſh the other muſt needs be taken away. For if that which extendeth bee cut aſunder, the part indeed ſhall be contracted or bent, but it ſhall alwayes ſo remaine becauſe the muſcle that ſhould extend is cut aſunder.*

A rule concerning muſcles that are a kinne.

Another concerning oppoſites.

The ſecond difference of Muſcles taken from the variety of their motion or action ſhall be this. Some Muſcles moue themſelues, others other bodyes. They which mooue themſelues are the *ſpinCters* of the fundament and the bladder: they which moue another body beſide their owne mooue a bone, or ſome other thing then a bone. Thoſe which moue a bone doe end in Tendons either greater or leſſe: they which moue another thing beſide a bone, ſome of them haue Tendons, and ſome haue none. They which moue ſuch parts as are eaſily mooued haue none, becauſe their motion is not vehement as the Muſcles of the Tongue and of the Teſticles; but the Muſcles of the Eyes haue Tendons, becauſe being continently and perpetually mooued, though it bee but a ſmall part yet it needes a ſtrong moouer.

The 2. difference of the muſcles taken from the actions.

The third difference of the Muſcles taken from the varietie of their actions reſpecteth their peculiars motions which are diuers; from whence they are called *Flexores*, *Tenſores*, *Attollentes*, *Deprimentes*, *Adductores*, *Abductores*, *Rotatorii*, *Circumagentes*, *Maſſeteres*, *Cremaſteres*, *SpinCteres*. That is, *Benders*, *Stretchers*, *Heauers*, *Sinkers*, *Too-ward*, *Fro-ward*, *Rowlers*, *Compaſſers*, *Mangers*, *Hangers* and *Binders*.

The third difference.

CHAP. VI. *Of the number of Muſcles.*

THE Authours of Anatomie haue not agreed vpon their verdit concerning the number of the Muſcles, neither to ſay trueth is the euidence ſo pregnant as to ingage a mans faith; ſome doe acknowledge more, and ſome fewer, ſome there are which looking with ſpectacles make many of one, and theſe increaſe the number, happily beyond the ſtint of Nature; ſome againe are ſo thicke

thicke sighted that of many they make one.

Wee in this one Chapter will comprise the whole forrest and confusion of Muscles into a briefe summe. *Siluius* hath giuen them almost all proper names, either from their action, vse, figure, or the similitude of some outward thing, which because they seeme to represent the matter with more life, and are beside a great helpe to memory, wee will retaine them in our History.

The number of the muscles is vncertaine. *Siluius* his names.

The Muscles therefore in the whole summe are foure hundred and fiue. First 2. of the forehead, 6. of the eye-lids, on each side 3; two doe open them, and foure shut them. The Eye is rowled after a strange volubility by 12. Muscles, 6. in each eye, the *heauer*, the *sinker*, the *too-ward*, the *fro-ward*, and 2. *rowlers*.

The muscles are 405.

The outward Eare is moued by sixe, 3. the right and 3. the left: two dilate the Nostrils and 2. contract them. The Lippes haue nine, 4. moue vpward and as many downward, and the ninth is called *Buccinator* or the *Puffer*, *Winder*, *Sounder* or *Trumpeter*. The lower Iaw hath tenne which moue it vpward, downward, forward, backeward and on both sides. The bone of the Tongue called *Hyois* (if at least it may bee called a bone) 8. muscles doe suspend and establish. The Tongue is moued like an Eele, vpward downward, forward backward and to the sides, by 10. muscles. The Choppes haue eight, 4. on eyther side which helpe the swallowing. The *Larynx* or Throttle is dilated, constringed, opened and shut by 14: foure common and ten proper. The Head hath likewise 14: sixe greater and 8. small ones. The Necke hath eight, 4. to bend it and as many to extend it. The Shoulder-blade hath all his motions performed by 8. peculiar muscles, foure in each shoulder-blade, *Trapezius*, *Leuator Proprius*, *Serratus minor & Rhomboides*, that is, the Table, the proper Heauer, the lesser Saw and the Plaice. The Armes are each of them moued with 8. their names are *Deltoides*, *supra-spinatus*, *latissimus*, *rotundus maior*, *pectoralis*, *Infra-spinatus*, *rotundus minor & subscapularis*, that is, the halfe Lozenge or triangle; the *Ridge-blade* or *blade-ridge* muscle, the broad muscle or Pruritane or claw-backe, the great Bowle, the Pectorall, the Snaile, the lesser Bowle and the Lurker. The Cubit hath foure, in each 2. benders and 2. stretchers: the 2. benders are called *Biceps & Brachiæus*: the 2. stretchers are called the *Long* and the *Short*. The *Radij* haue each of them foure, two fore-bowers, the *round* and the *square muscles*, and as many backe-bowers. The VVrest is bent by two, and extended by other two. The Fingers (excepting the thumbe) haue 3. benders, *Palmaris*, *Sublimis* and *Profundus*, the Palme muscle, the Floating muscle and the Deep muscle, and foure stretchers; 4. *too-ward* which are called *Vermiculares* or the wormes, and 6. *fro-ward* called also *Interossei*, because they lye among the bones; in all 17. The thumbe hath nine, 1. bender, 2. stretchers, 3. too-wards, and as many fro-wards. There is also in the little finger a peculiar muscle which moueth it froward the rest, so that in each hand there are 27.

A briefe innumeration of all the particular muscles.

The Muscles seruing for Respiration are in all 65. of which 32. doe distend or dilate the Chest, and as many contract it. Valuable to all which for both vses is the odde Midriffe. As for those 11. internall and externall, which are fancied to bee betweene the gristles of the ribbes we doe not acknowledge them sayeth *Laurentius*. The *Abdomen* hath 10. muscles, 4. oblique, 2. right, 2. transuerse and 2. small or pyramidall muscles. The back is moued by ten, 5. on each side. The Fundament hath foure, 2. *sphincters* and 2. *heauers*. The Bladder hath 1. *sphincter*. The Testicles haue 2. muscles called *Cremasteres* or hangers and suspendors. The Yarde hath 4. The Thighes are each of them bent by two called *Psoas* and *Iliacus*, and three stretchers, which are they that make the substance of the Buttocks, there also are too-ward muscles and 6. froward, 2. *obturatores*, and 4. twinnes called *quadrigemini*, wherefore the muscles of the thigh are in all 28.

The Legge hath foure benders called *postici* or the posterne muscles, and so many stretchers, the right, the 2. Vast & the *Crureus*; two are too-ward, the Long and the Ham muscles, and 1. is fro-ward called *membranosus*, so that the muscles of the Legges are two and twenty.

The Foote hath 2. that bend it, that is altogether in the in-step called *Tibiæus anticus* & *Peroneus*, and 4. which stretch it, 2. twinnes *Soleus* and *Plantaris*.

The Toes haue 2. benders, *Sublimis & Profundus* and 2. stretchers, 4. too-wards called the VVormes, 8. frowards called *Interossei*. The great Toe hath 1. bender, 1. proper stretcher, 1 too-ward and another fro-ward. There is also one peculiar fro-ward muscle of the little Toe, so that in each foote there be 21. muscles for the mouing of the Toes. The to-

tal

tall ſumme of all theſe in the whole body is foure hundred and fiue: whether thou wilt add more or make theſe fewer, for my own part ſaith *Laurentius* I do not greatly care, no more doe wee but haſte on to our peculiar Hiſtorie of the Muſcles of each part, beginning with thoſe of the Head.

CHAP. VII. *Of the muſcles which moue the skinne of the Head.*

WE haue ſaide before that the skinne of the Head is moued according to our good pleaſures, in ſome men all of it round about, but in moſt onely the skin of the forehead and the face. The Antients, as *Galen* for example in his 11. Booke *de vſu partium* and the fifteenth chapter, thought that this motion came from a thinne and muſculous ſubſtance which is ſubiected or lyeth vnder the skinne of the forehead and is vnited thereto as the palmes of the hands and Soales of the foote are vnited with their Tendon. But the late writers with more euidence of truth by curious obſeruation haue found out and allotted to euery part of the face his peculiar muſcles, for we call all that the face that may be ſeene outwardly. Some of theſe are in the forepart of the face, as the forehead, the Eyelids, and the noſe: others in the backe part of the head called *occipitium*; ſome on both ſides, as in the eares the lippes and the cheekes.

Galen.

What wee meane by the Face.

The skinne of the forehead (which by his tenſion and corrugation, that is, ſmoothneſſe or wrinkling demonſtrateth the manifold affections of the mind) is mooued not onely by the helpe of the fleſhy membrane, growne more fleſhy as *Veſalius* thought, and ſo being vnited to the fleſh vnder it, paſſeth into a muſculous ſubſtance furniſhed with right fibres, but alſo by two muſcles, as appeareth both by the courſe of their fibres and by their motions; the fibres appeare in theſe after the maner of other muſcles, and their motions is not like the motion of the fleſhy membrane.

The skinne of the forehead ſheweth the affections of the mind.

Falopius alſo and *Platerus* haue giuen them names. *Fallopius* calleth them the firſt paire mooving the skinne of the head, and *Platerus*, the muſcles of the affections. Theſe are ſeated in the forehead, and doe ariſe aboue where the haire determines ſometime as high as the crowny ſeame neare the temporall muſcles, the right at the right and the left at the left temple (where the fleſhy membrane cleaueth ſo cloſe to the ſcull-skinne and the ſcull it ſelfe, that it is altogether immooueable, that the forehead and the eye brows might be mooued when their membrane is at reſt) and toward the common ſeame which diſtinguiſheth the bones of the head from thoſe of the vpper iaw are implanted with right fibres aboue the eyes and the noſe into the skinne at the browes, as at the parts which are to be mooued: for when the browes are mooued they draw in a ſtraight line together with them the skinne of the forehead. I ſaid right fibres and not oblique as ſome haue thought and therfore Chirurgions muſt obſerue that in opening apoſtemations in that place, they make not their inſitions ouerthwart as the wrinkles of the skin doe goe, but according to thoſe right fibres.

A good note for Chirurgions in opening Apoſtumations in the forehead.

Wee muſt alſo obſerue that theſe two muſcles are a little diſioyned in the middeſt toward the top of the forehead, and that is the reaſon why the vpper part of the forehead is not mooued; but at the toppe of the noſe, where alſo they become more fleſhy they are ſo ioyned that they ſeeme to be but one muſcle. But that they are two, not onely Anatomie but alſo reaſon and experience do teach; reaſon, becauſe Nature hath made all members double that the body might be equally ballanced: Experience, becauſe we finde that if one of them be either taken with the palſey or wounded ouerthwart, the affected onely looſeth his motion and not the other, whereas if there were but one, there ſhould be no motion at all. And *Columbus* maketh mention of a Cardinall whoſe left muſcle ſuffering convultion by reaſon of a wound he receiued aboue his brow, did notwithſtanding moue the halfe of his forehead. Againe, when we are mooued to diſpleaſure, wee contract and wrinkle the skinne in the middle of the forehead, ſo that the browes doe almoſt touch one another: which contraction of the skinne could not bee made if there were but one muſcle.

That there are 2. muſcles.

A Cardinall.

The vſe of theſe muſcles is by the contraction of their fibres to lift vp the browes together with the skinne of the forehead, and vpon their relaxation to ſettle them againe. For the forehead is mooued as *Galen* elegantly diſcourſeth in his 11. Booke *de vſu partium* and the fourteenth Chapter becauſe of the eyes: for when the forehead is lifted vppe the browes alſo flie vpward and the eyes are better opened to ſee more at once. And againe,

The vſe of theſe muſcles.

The muſcles which draw the skin of the head backward.

when the eyes are ſhut for feare of any thing which ſhould ruſh vpon them, they are better and more ſtrongly cloſed by the falling of the browes and the forehead. The muſcles which draw the sinne of the head backeward are two, one either ſide one, ariſing verie ſlender from the tranſuerſe line of the *occiput* or nowle of the head, into which line the ſecond muſcle of the ſhoulder-blade called *cucul'aris* or the Cowle doth determine: from this line doe runne fibres directly vpward and make theſe muſcles, which are very ſhort & not aboue an inch, but yet ſo broade that either of them toucheth the eare of his owne ſide, and they end into a thinne and broad Tendon, which ſeemeth to be made of the fleſhy membrane, and occupyeth or compaſſeth the whole head and the fore-muſcles of the eare, and ioyneth alſo together the muſcles of the forehead. The vſe of theſe 2. muſcles is to draw the Skinne of the Head backeward; and therefore *Columbus* thought that they drewe alſo the eye-browes and inſtanceth in the example of one *Iohannes Antonius Platus*, who could moue the whole skinne of his head very ſtrongly as alſo could *Columbus* himſelfe. But as the muſcles of the forehead are neuer wanting, ſo theſe of the nowle and the fore-muſcles of the eares (as *Falopius* and *Platerus* haue alſo obſerued) are but ſeldome found.

Why ſome men can moue the skin of their head.

Aquapendent his muſcle of the eie brows.

Beſide theſe *Aquapendens* aſcribeth to the eye-browes a round muſcle differing from the circular muſcle of the eye-lids, becauſe that of the browes hath thicker and more fleſhy fibres, and beſide is ſomewhat larger; drawing the brow eſpecially downeward to the eye, and being like vnto a Ring attracteth alſo the lower lid very ſtrongly.

CHAP. VIII. *Of the Muſcles of the Eye-lids.*

Great differences amõg Anatomiſts concerning theſe muſcles

WHat the Motions of the Eye-lids are and their neceſsities, as alſo of what kind Voluntary or Naturall with other circumſtãces thereto belonging, we haue declared before in their Hiſtory. Nowe concerning the number of theſe muſcles whereby theſe motions are effected, I finde great difference betweene *Galen* and the late Writers, and amongeſt the late writers themſelues.

Galen and the ancients with whome *Veſalius* and *Syluius* doe agree do make two, deuiding the orbicular muſcle of which we ſhall treate anon into two: one lifting vp the Lid, the other bearing it downe. *Laurentius* is of the ſame mind for the deuiſion of this muſcle but not for the Vſe, for he thinketh that they both ſerue to ſhut the vpper Lid: ſo that it ſhould ſeem that *Galen* and thoſe that ſide with him did not know of any muſcle which ſhould open the eie. *Falopius*, *Platerus*, *Bauhine*, *Laurentius* and *Aquapendes* affirme, that for the opning of the eye there is but one muſcle. *Columbus* and *Archangelus* ſay there are two; the firſt wee admit, the ſecond wee ſay ſerueth to rowle the eye. But to paſſe by theſe contentions you ſhall giue me leaue to reſolue the matter thus.

The motions of the Eye-lids are performed by two muſcles, one right in the vpper Lid which lifteth it vp, and the other round. The right muſcle (which *Galen* knew not, neither *Veſalius* nor *Syluius*, but *Falopius* challẽgeth the inuention of) which lifteth vp the vpper Lid [ta. 1.M] is ſeated within the concauity of the bones in the vpper part of the orbe aboue and neare the muſcle which lifteth vp the eye to which in figure it is very like, and fleſhy but leſſe, and ariſeth backeward at the in-let of the opticke nerue from the ſame originall with the other muſcles which mooue the eye, and being directly ſtretched to the vpper Lid is inſerted with a broade tendon into his end or cartilage. His vſe is by contracting his fibres inward to draw the vpper Lidde vpward (for the lower ſetleth into his place of his owne accord) and ſo vncouering the eye it openeth it.

The place of the right muſcle.

The orbicular or round muſcle.

His poſition.

The ſemicircular or round Muſcle [ta. 1.K] is ſeated betwixt the fleſhy membrane & that which is produced from the *Pericranium* or Scull-skinne, and is membranous and very thinne or ſlender, yet a little increaſed by certaine circular and fleſhy fibres which he borroweth from the fleſhy membrane, and ſo ſtandeth halfe round in either Lid.

His original.

It ariſeth with a ſharpe beginning at the roote of the noſe in the great and inward angle of the lower Lidde where the common ſuture is betweene the heade and the vpper iaw, from thence it proceedeth all along the latitude or breadth of the ſame Lid, and

Progreſſe.

is inſtantly inlarged and returned to the outward angle toward the vpper part of the orb,

And inſertion

and paſsing on by the vpper Lid is inſerted with a ſharp end into the vpper ſide of the inner angle, and ſo maketh an exact circle, compaſsing the outward circumference of both the Liddes. Yet *Falopius* excepteth the inner part of the great angle, from which it is

prohi-

prohibited that it might not be altogether circular.

His vſe is, that being drawne toward his originall, it might at one and the ſame time moue the vpward eyelid downeward and the lower vpward, thereby ioyning and binding them together. And that this is ſo, it appeareth as well by the continuitie of the fibres in the circumference and in the angle, as alſo by the motion in the ſame angle, eſpecially if it be a little more conſtrained ſo as wee muſt needs winke ſomething withall: and this may be manifeſtly perceiued both by the ſight and by the touch. For nothing ioyned can be ſtrictly drawne together ſo as they touch one another, vnleſſe ſome parts be drawn vpward and ſome downeward. This muſcle in reſpect of his fibres which are continuall is moſt truely ſaid to be one, but in reſpect of the two lids may bee called two ſemicirculat muſcles: for being ſeparated they make a halfe circle, but ioyned together, they make it perfect. This muſcle *Galen* knew, and in his tenth booke *de vſu partium* at the ninth chapter, he prooueth how all the motions of the eye lids are abſolued by it, hee deuideth it alſo and addeth, that one of them draweth too the great angle toward the Noſe, and the other vnto the leſſe toward the Eare, and that when the firſt draweth the lid is depreſſed, but lifted vppe with the latter. But becauſe the fibres of this muſcle are continuall through the whole lid, although it alſo bee mooued vpward and downeward, yet is there no muſcle which hath right motion but onely this forenamed circular muſcle which draweth it vpward, indeed but rather toward the inward angle or corner, as it were to his beginning, as euery man may perceiue by touching that part in himſelfe; and yet I know that ſome thinke this motion proceedeth from the motion of the cheekes.

The vſe of this circula muſcle.

How this muſcle may be ſaid to be two.

Why it can be but one.

Wee conclude therefore that the motion of the lids is accompliſhed by two muſcles, one right, which being in the vpper lid eleuateth it; the other orbicular or round and is in both the lids, which when it is ſtretched doth at the ſame time draw the lower lid vpwards and the vpper lid downewards: and when there is need of a ſtronger contraction or cloſer ſhutting together, then alſo the orbicular muſcle of the eye browes whereof we made mention before is drawne in to bee aſſiſtant, like as when wee would open the eye more ſtaringly, the muſcles of the forehead do much helpe vs.

Concluſion.

Hee that would demonſtrate theſe nice and curious muſcles, muſt haue a very ſmall knife and very keene, wherewith he muſt firſt ſeparate the skinne in the meane time taking care that he doe not cut the fibres of the muſcle, eſpecially in the angles: then ſhall he ſeparate the muſcle below at the *Tarſus* or edge of the lid, and aboue at the eye brow. *Falopius* in his obſeruations confeſſeth that he was a long time of the ſame opinion with *Galen* and *Veſalius*, but in the yeare 1553. tooke knowledge of his error, being admoniſhed partly by *Oribaſius* in his booke *de diſſectione muſculorum*, and the 29. chapter, and partly by diſſecting the eye of a fiſh called *Phoca*, which is the Sea-calfe, which fiſh mooueth both his Eye lids. But we proceed vnto the muſcles of the Eyes.

How theſe muſcles may be diſſected.

How *Fallopius* came to learn the right muſcle.

CHAP. IX. *Of the muſcles of the Eyes.*

BEcauſe our Eyes were giuen vs as ſpies and ſcout-watches that wee might purſue profitable things and auoyde whatſoeuer is hurtfull, Nature made not them immoueable, for then they ſhould haue diſcerned only that which was oppoſite vnto them, for ſo ſaith *Ariſtotle* in his ſecond booke *de partibus Animal* & in the tenth chapter. We ſee *per directum*, that is, by a ſtreight line not in euery poſition ſaith *Galen*, becauſe oblique, ſide, backward, higher and lower obiects do not fall in with the ball of the Eye. Wherefore it behooued they ſhould be ſo diſpoſed that they might moue and turne themſelues on euery ſide at their pleaſure. Theſe motions according to *Galen* in the third chapter of his firſt book *de motu muſculorum* are ſixe in number, and therfore each eye muſt haue ſixe muſcles, in beaſts there are ſeauen, eſpecially ſuch as goe on all foure, which deceiued *Galen* and ſome late writers, who were accuſtomed onely to diſſect the Eyes of brute beaſts, yet hath the Ape but ſixe: The ſeuenth where it is, may be deuided into two, three or foure. In men, as I ſayd, they are ſixe according to the ſixe motions of a mans Eye, fower of which motions are right, vpward, downward to the right hand & to the left: two motions are oblique, to which belong 2. oblique muſcles, whoſe vſe is to rowle the Eye about: notwithſtanding one of theſe is exactly oblique, the other partly right and partly oblique.

How many motions in a mans eye.

All theſe muſcles are ſeated on the backeſide of the Eye within the cauitie of the Scull whither they accompany the Opticke nerue: and ſo remaining in their poſition the

The figure of the Eye.

eye, and they together do make a pyramidall figure. [Tab. 1. fig. 6 and 7] Among theſe the thicker and more corpulent are the right Muſcles, which haue all the ſame ſtructure, original and inſertion, and do paſſe ſtraight all along the length of the eye, the oblique are leſſe fleſhy. Theſe Muſcles are all ſmall, that they might bee ſooner mooued, but that which helpeth moſt the volubility of their motion is the round figure (which is the ſwifteſt of all other motions as we may perceyue by the roundneſſe of the heauens) for by it euen in a moment they are conueyed ouer the one halfe of the sky.

The quantitie of the Muſcles.

The foure right Muſcles meeting towards the roote of the Nerue Opticke, doe ariſe with a ſharpe beginning from the lower part of the Orbe which is made by the Wedge-bone, hard by the paſſage through which the Nerue of *Sight* doth yſſue.

Diuers opinions.

I know there be ſome who imagine that they ariſe from a mixture of the *Dura Mater*, and a Nerue of the ſecond paire. Others, from the Membrane which compaſſeth the Orbe of the eye, and that other Membrane which inueſteth the Nerue Opticke: ſome from the *Pericranium* as *Aquapendens*, but we will reſt vpon *Bauhines* opinion for their originall. Their whole bodies are fleſhy, and they beare out their bellies rounde when they come forward, and a little aboue the middle of the eye they determine into a broad thin and Membranous Tendon, where-with they compaſſe the whole eye before, and grow very ſtrongly to the horny tunicle neere vnder the Rain-bow in the great Circle: and theſe tendons ioyned together do make that nameleſſe coate of *Columbus*, and the halfe-tranſparent white of the eye: for I thinke that this whiteneſſe is cauſed rather by the Tendons of theſe Muſcles then by the coate which they call *Adnata* or the cleauing coate.

Veſalius. Platerus Bauhine.

Whence proceedeth the white of the eye.

But we will giue you a more particular deſcription of them ſeuerally. The firſt [tab. 2. fig. 1. 3. 4. ᵖ fig. 5. ſ] which is the third (according to *Galen* and *Veſalius*) is placed aboue, fleſhy and round, thicker then the reſt, and greater and ſtronger it is then the ſecond, lifting vp the eye toward the browes: for there is more ſtrength required to lift any thing vp then to pull it downe; it is called the *proud Muſcle*, becauſe the motion thereof lifteth

TABVLA. II.

FIG. I.

FIG. II

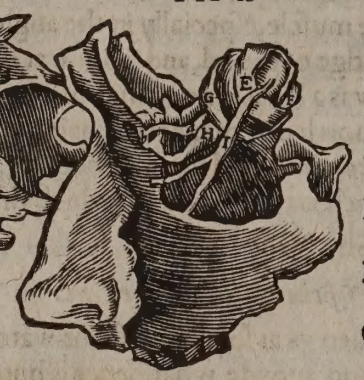


FIG. III.

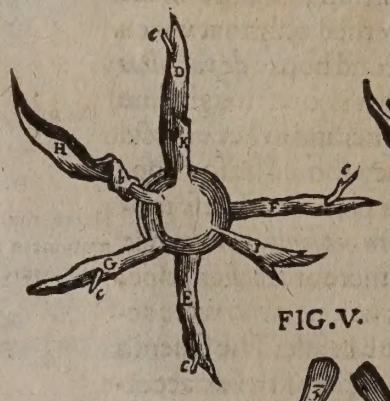


FIG. IV.

FIG. V.

Table 2 figu. 1. ſheweth many Muſcles of the eye in their owne ſeate. Figu. 2. ſheweth the eye rowled vpwarde whereby his Muſcles may be perceiued. Figur. 3 & 4. ſheweth the Muſcles of the eie ſeparated before and behinde with theyr Nerues. Figu. 5. Is the eie of an Oxe, with his Muſcles ſeuered as Veſalius doth ſhew it.

C, the Muſcle lifting vp the eyelid.

D. 1, 3, 4. The right vpper muſcle of the eie in 3 & 4 with the Nerue.

E, 2. 3, 4. the right lower Muſcle of the eie in 3 and 4 with the Nerue.

F, 1, 2, 3, 4. the right external Muſcle of the eye.

G 1, 2, 3, 4, the right internal Muſcle of the eye.

H, 1, 2. 3, 4. the oblique ſuperior muſcle or the pulley, whoſe tendon is marked with *a* and the pulley with *b*.

1, 2, 3, 4. the oblique inferiour muſcle of the eye.

a 1, 2, the tendon of the oblicke ſuperiour Muſcle.

α, *β*, the ſecond Muſcle of the eyelid lying in the cauitie of the eye, whoſe broade Tendon *β* is inſerted into the eielid.

γ, 5, the haires of the eyebrowes.

δ ε, two right Muſcles leading the eye vpward and downward.

ζ, *η*. 5. Two right Muſcles mouing vnto the right and left ſide.

B 1, 5. two oblique muſcles lightly turning the eye.

κ, *λ*. The ſeauenth Muſcle which may be diuided into more.

vp the eye with a kinde of diſdaine.

The ſecond [tab.2.f.2,3,4.ª f.5.ª] is placed in the lower part oppoſite to the firſt, and according to *Galen* and *Veſalius* it is the fourth: it draweth the eye downeward towardes the Cheekes, and therefore needed not to be ſo great as the former; for the eye declineth with his owne weight: it is called the depreſſor and the *humble* Muſcle, becauſe in baſhfulneſſe we draw our eyes downward toward the lower lid. The ſecond.

The third [tab.2.f.1,2,3,4,ᶜ. f.5.ζ] according to *Galen* and *Veſalius* the firſt, is ſeated in the greater angle, and leadeth the eye inward toward the noſe, and is called the *To-leader* and *Bibitorius*, we may call it the *ſquinting* Muſcle. The third.

The fourth [Tab.2.fig.1.2.3.4.F fig.5.ν] the ſecond according to *Galen* and *Veſalius*, is oppoſite to the third, ſeated on the outſide of the eye which it draweth outward to the leſſer angle or to the temples, & is called the Fro-leader or the muſcle of Indignation or the VVayward muſcle. The fourth.

By theſe foure if they moue together the eye is drawne inward, ſtabliſhed and conteyned, which kinde of looke we in our language call a *wiſte-looke*, the motion the Latins call *Tonicall*.

The fiſt [tab.2.fig.2.3.4.I fig.5.B] is the fiſt alſo according to *Galen* and *Veſalius*, but the ſixt according to *Falopius*, *Platerus* and *Laurentius*. It is ſeated on the outſide in the lower cauity, and ariſeth betweene the eye and the tendons of the ſecond and fourth muſcles (which is the reaſon why ſome haue thought that it taketh his beginning from the eie and is againe inſerted into the ſame) from that cleft which appeareth like a ſuture of the bone of the lower orbe where the firſt bone of the Iawe is ioyned with the fourth: ſometimes it ariſeth with a fleſhy beginning from a bony ſcale. The fiſt.

It is ſlender, round, ſhort and exactly oblique, and paſſeth obliquely toward the outward angle, as it were to embrace the eye with a ſhort and ſomewhat round tendon, and is implanted with a thin and ſinnowy end in an oblique line by the Rainbowes ſide nere the inſertion of the ſixt muſcle: ſo that ſometimes the tendons of them both ſeeme one and the ſame. His figure. His implantation.

To recite here the altercations of Anatomiſts about this muſcle would rather intangle our Readers then giue them any great ſatisfaction; eſpecially ſeeing ſuch learned men to whome ſo curious diſquiſitions will not ſeeme tedious, may repaire to thoſe fountains from whence we haue deriued theſe riuerets: we paſſe vnto the vſe, which is by the contraction of his fibres to rowle the eye obliquely downward toward the outward angle.

The ſixt [Tab.2.fig.1.2.3.4.H fig.5.ι] ſo alſo according to *Galen* and *Veſalius*, but the fiſt according to *Fallopius*, *Platerus* and *Laurentius* is ſeated on the inſide and the vpper part yet vnder the right muſcles, and is partly right and partly oblique. It ariſeth from the ſame place with that which draweth the eie directly to the inner angle at the ſide of the opticke nerues paſſage on the backe of the orbe. The ſixt. His originall.

It determineth as well in man as in beaſtes into a round ſmall and long [tab.2.fig.1. and 2.ª] tendon almoſt at the vtmoſt skirt or edge of the inward angle. His end

This Tendon is reflected through a ſmall griſtle hollowed like a cane or pipe, and placed in the greater angle which *Falopius* firſt of all found out, and called it *Trochlea* or the pulley, and thence proceeding obliquely to the right angle [tab.2.fig.1.and 2.B but in the 3.and 4.fig.it is ſliuen from the bone] toward the vpper part of the eye, it is inſerted betweene the firſt and the fiſt muſcles ſomewhat oblique; all which time the forefayde Tendon is compaſſed about with a certaine Ligament as it were with a ſheath. This Muſcle being drawne inward to his originall with his tendon, he turneth the eye in a circular motion to the inward angle. Theſe two the one aboue the other below, are called the Rowlers or the Muſcles of Loue: the ſixt alſo ſome call *muſculum trochleæ*, or the Muſcle *of the Pulley*. His progreſſe. His inſertion.

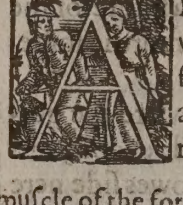
The ſeauenth Muſcle which is for the moſt part found in bruite beaſtes [tab.2.figu.5.ᵡ] is ſet vnder the former ſixe, and hath of it ſelfe that figure which the former ſixe doe together make: it is ſhort and compaſſeth round the opticke nerue [table 2.fig.5.λ] yet is there ſome fatte betweene them; proceeding forward it is dilated, imbracing the whole globe of the eye at the roote; it maketh alſo a circle euen as the foure firſt neare the Rainbow did make a circle with their Chordes: at his inſertion which is into the hard tunicle of the eye, it becommeth fleſhy and may be deuided into 3. or 4. ſo as *Galen* doubteth whither it be one, or double, or treble. The 7. muſcle His figure. His inſertion.

His vſe. The vſe of this muſcle is to tye vp and ſtrengthen the eies of bruite beaſtes hanging alwaies downeward that they ſhould not fall with their owne waight; it alſo encompaſſeth the nerue opticke making his paſſage more ſtraight, ſo as in violent concuſsions or motions it may neither leane againſt the bone nor be indangered by diſtention.

Why a man hath not the 7. muſcle. This Muſcle, Nature or the God of Nature rather did not ſee needfull for man; becauſe he hath a countenance erected vp to heauen; and if at any time he be conſtrayned to looke downeward, hee hath all the right muſcles with their ioynt ſtrength to ſuſtaine the Eye, becauſe they growe with their fibres to the membrane which compaſſeth the orbe.

How to make diſſection to ſhew the muſcles beſt. To finde out the Muſcles of the eye, when the braine is taken away you muſt cut the orbe at each corner euen to the nerue opticke with a Saw, hauing a great care leaſt the *Trochlea* or Pully which is in the inner angle bee offended. Then you muſt ſeparate the *Pericranium* from the bone, and breake the vpper part of the orbe backeward, then take away the fat, and ſo ſhall you perceiue the muſcles of the eye-liddes and of the eyes themſelues together with their veſſels: and if you would obſerue the proper and peculiar motion of euery muſcle; you muſt preſerue them in their proper poſition, and tye to euery one of them a thred not far from their tendons and then draw the thred. You may alſo take the eye whole out of the orbe together with the *Trochlea* which is in the inner angle, and ſo demonſtrate what you pleaſe. And thus much of the Muſcles of the Eye.

CHAP. X. *Of the Muſcles of the outward Eare.*



ALthough moſt commonly mens Eares are immouable, and few there bee who haue any ſenſible motion of them; yet that the mooving faculty may flow into them is manifeſt as well by their muſcles whoſe action is motion, as alſo by the nerues which thereabouts are commonly ſeene. Now the reaſon why this motion is ſo rare and ſo hardly perceiued is three-fould.

A 1,2, The muſcle of the forehead and the right fibres there of.
B 1,2. The temporall muſcle.
αβγ 2, His ſemicircular originall,
CE 1, the firſt muſcle of the eye-lidde compaſſing the whole lid.
FD 1, the third muſcle of the wing of the noſe which endeth into the vpper lip.
GH 1, the muſcle of the vpper lip.
I 1, the broad Mouſe-muſcle ſtretched ouer the cheeks and all the lower parts.
δεζθ the circumſcription or circumference of this muſcle.
I 2. The grinding muſcle or the ſecond muſcle of the Iaw.
M 2, a muſcle forming the cheekes.
N 2, the muſcle of the lower lip,
O 2, a part of the fift muſcle of the lower iawe called *Digaſtricus*, that is, double bellied.
QR 2, The firſt muſcle of the bone *hyois* growing to the Rough artery.
S 2, the ſecond muſcle of the bone *hyois* vnder the chin
The lower T in the ſecond figure ſheweth the third muſcle of the bone *hyois* ſtreatched to the iaw. The vpper T in the ſecond figure ſheweth the inſertion of the ſeauenth muſcle of the head.
V V 2, two venters of the fourth muſcle of the bone *Hyois*.
The backeward K (put inſtead of *X*) ſheweth the ſeauenth muſcle of the head and his inſertion at the vpper T.
κλ 2, The originall of the grinding muſcle from the yoke-bone.
μ 2, the inſertion of this muſcle into the lower iaw,
ρσ 2, two beginnings of the ſeauenth muſcle of the head.
T 2, his inſertion into the *Mammillary* proceſſe.

Table 3. Fig. 1. Sheweth the muſcles of the Fore-head, the Eye-lids and the Cheekes.

Figure 2. ſheweth the Muſcles of the Noſe, Lips, the lower Iaw and of the bone Hyois.

TABVLA. III.

FIG. I.

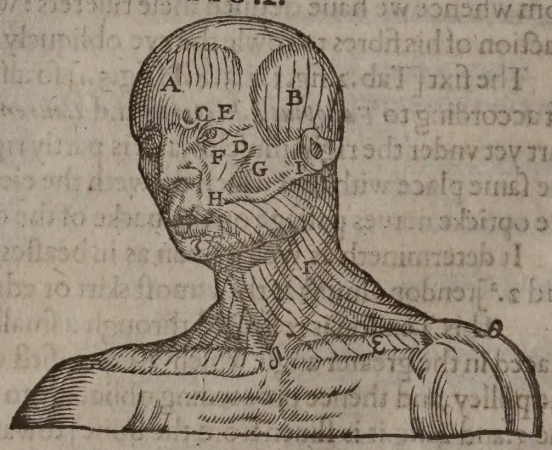


FIG. II.

The

The first, becauſe the muſcles of the Eares are ſo ſmall (*Galen* in the 6. Chapter of his 16. Book *de vſu partium*, calleth them but delinations of muſcles) and the nerues ſo thredy that a ſufficient quantity of mouing ſpirits cā not be conuayed through them. The first reaſon.

The ſecond, becauſe if they ſhould be moued, the hearing would be deprаued or vitiated, eſpecially mens eares being ſmal, and therefore Nature hath made recompence by the eaſie and ſpeedy motions of the Head whereby we turne on euery ſide to receiue the ſoundes; whereas in foure-footed beaſtes their eares being greater and the motions of their heades not ſo nimble, they are alwaies moouable to receiue the ſounds from euery ſide; with them alſo they driue away Flies which men can doe with their hands. Secondr. aſon

The third reaſon is becauſe mens eares are ſhort and griſtly, ſo as the muſcles and branches of the ſinnewes cannot be dilated in them. But ſuch as they are we owe the honour of their inuention to *Fallopius*. They are of two ſortes, Common and proper, and conſpicuous enough in thoſe men whoſe eares we can perceiue to mooue. Third reaſon

The firſt is common to the eare and to both the lippes, and is a ſmall portion of that Muſcle which is accounted the firſt of them which mooue the Cheekes, and the skin of the face called *Quadratus*, [tab. 3. fig. 1, r] or the ſquare Muſcle. This ſometimes becommeth fleſhy and aſcending with his Fibres to the roote of the eare [tab. 3. fig. 1 °] is inſerted vnder the lap, and draweth it downward to this or that ſide. This Muſcle is broade, thin and foure ſided.

The ſecond, which is a proper muſcle [tab. 3. fig. 1. neere to [B] Tab. 4. fig. 1. [BB.] fig. 2. [A]] is ſeated in the fore-part, and lyeth vpon the temporall muſcle, ariſing from the vpper end and extremity of the muſcle of the forehead, where it toucheth with the temporall: this deſcending towarde the eare becommeth narrower, and at his inſertion into the vpper part of the eare very tendinous; it is thin being produced out of the fleſhy Membrane, which is but ſprinkled with fleſhy fibres, as alſo are the other Muſcles of the eares: it is much leſſe then the temporall, and from roundneſſe becommeth long. His vſe is to His originall. His inſertion.

Table 4. Fig. 1. ſheweth the ſkinne of the Head togetogether with the Fat and the glandules vnder the eares, and the Muſcles of the hinder part of the head and the Eares.

Figure 2. ſheweth the Muſcles of the eares, of the Eyebrower, and a few of the iawes.

FIG. I.

FIG. II

BB. The Muſcle of the eare ſpringing from the *pericranium* or Scul-skin.

C. The triangular muſcle mouing the skin of the nowl of the head.

The ſecond Figure.

A. The ſemicircular Muſcle of the eare, drawing the outward eare vpward, which was noted with B in the firſt figure.

B, C, D, E, F, G. the Muſcle as it were diuided into three parts, called *Tripartitus*.

H, the hinder part of the outward eare into which the foreſaid Muſcle is faſtned.

NNN, the circumference of the temporall Muſcle.

O, the Muſcle yet couered with the *pericranium*.

P, the Membran couering the ſaid muſcle drawn aſide

QQQ. The fleſhy part of the temporall Muſcle.

V. Tne Muſcle *maſſeter* or grinding Muſcle, remooued here from the yoake-bone, whence it hath his originall, that the implantation of the temporal muſcle into the proceſſe of the iaw might appeare.

X, the Muſcles making the cheekes.

Z, A Muſcle of the lower lip.

a a, the Muſcle of the eyebrow.

bb, the vpper eyelid hauing a Muſcle with tranſuerſe Fibres.

c, the eyebrow hauing a circular Muſcle, whereby the external parts of the eye are exceedinglie conſtringed, as *Placentinus* ſaith.

draw

draw the eare vpward and foreward.

The thirde. The third [tab.3.fig.1 neere to O] ariſeth from the nowle or *Occipitium*, and from the couerings of his Muſcles aboue the Mammillary proceſſe or teat-like extuberation, wher the Muſcles that mooue the head and the ſhoulder-blade do end. In his beginning hee ariſeth narrow but paſsing downeward ouerthwart becomes ſome-what broader, as if it were diuided into two or three fingers, and is ſo implanted on the backe ſide of the eare to draw it backward and ſomething vpward.

The fourth, The fourth proceeding from the ſame Teate-like extuberation or Mamillary proceſſe, vnder the Ligament of the griſtle of the eare, is of a broad, fleſhy and fibrous ſubſtance, but in his progreſſe becommeth narrower till it end in a Tendon, which tendon is faſtned into the whole roote of the eares griſtle [Table 4.fig. 2 H] one part of it aboue another part in the middeſt, and the third below. And hence it was that *Placentinus* a ſtudious and painfull Anatomiſt, out of this maſſe maketh three [Tab.4.fig.2 B C D B E C] muſcles led hereunto by his inſertion; all which notwithſtanding he ſaith do ariſe confuſedly out of one place.

Placentinus his conceite.

CHAP. XI. *Of the Muſcles within the Eares.*

The motion within the eare, BEcauſe theſe Muſcles are very ſmall, euen the ſmalleſt in the whole bodye, and beſide their poſition depending vpon the curious parts of the eare, we haue deſcribed them more at large before in the nineteenth chapter of the eight Booke, wherefore heere wee will onely make a little mention of them and trouble you no further in this place. The Hammer and the Anuile haue but a verie obſcure motion, yet are they mooued, together with that Membrane whereto the Hammer is tied, vpward and downward by one Muſcle within the membran & another without it. The inner muſcle [tab.5.fig: 2.] was firſt deſcribed by *Euſtachius*, & is ſeated in the Rock-bone. It is the leſt in the whole body, ſo alſo it is of the moſt elegant and dainty compoſition. It ariſeth in the baſis of the bone called *Sphenoides* or the wedg-bone in that place where with the roote of the proceſſe of the Rocke bone and an additament of the Nowle-bone, it maketh a broken hole. His beginning is like a Ligament, afterwarde it becommeth fleſhy, and by degrees euen vnto the middeſt groweth a little broader, after becomming narrower againe, it endeth into two exceeding ſmal tendons, [tab.5.fig.5 belowe] whereof one is inſixed in the higher proceſſe of the Hammer, and the other vpon his necke. This Muſcle draweth the head of the Hammer obliquely forward and inward, leadeth it from the Anuile, and driueth the Membrane outward from the crooked proceſſe of the Hammer.

The ſmalnes and elegancie of it.

This fift Table is all one with the eleuenth Table of the eight Booke.

The ſecond Muſcle. The other Muſcle, is ſeated about the middeſt in the vpper part of the Hole of Hearing, called *Meatus auditorius* without the Membran of the Tympane or Drumme. And about the inuention of this Muſcle, two of the beſt Anatomiſtes of *Padua* in *Italy* dooe contend.

The firſt inuenters therof. For *Hieronimus Fabricius ab Aquapendente* affirmeth, that he found it in the yeare, one thouſand fiue hundred ninety nine. Alſo *Iulius Caſerius Placentinus* ſaith, that hee obſerued it firſt the ſeauenth day of March, in the yeare one thouſand fiue hundred ninetie three. Which of them was the firſt inuenter I cannot ſay, but both their diligences deſerue great commendations.

The vſe both of the former internall, and alſo of this externall Muſcle *Aquapendens* expreſſeth on this manner.

The vſe. The vſe of theſe Muſcles is to preſerue the Membrane, which being in danger to bee broken or ſtretched in two places, both within and without; Nature hath prouided a defence on either ſide. For on the outſide the externall aire being violently mooued together with the ſound, might driue the Membrane inward: and within the Included ſpirit or the aire paſsing from the mouth into the paſſages of Hearing, might offer violence vnto the ſame membrane by driuing it outward, as in oſcitations or yawning gapings, in blowing of the Noſe, in retention of the breath, in ſtrayning of the Voyce, in emptytying the belly, and ſuch like: and therefore the outwarde Muſcle beeing drawne

The prouidence of Nature.

inward

inward together with the membrane by the violence of the aire doth with his owne motion retract it outward againe, and contrarywiſe the inner muſcle when the membrane is thruſt outward retracteth it backe againe inward: and thus theſe two muſcles keepe the membrane from breaking. And truely it is very neceſſary that this office of the cuſtody of the membrane ſhould be committed to a muſcle and not vnto a ligament: that as the impulſions or motions of the aire againſt the membrane be diuers, ſo the cohibition or reſtraint and retraction of the membrane toward his owne ſeate ſhould alſo bee diuers. Now we know that a ligament worketh alwayes after the ſame tenour or manner, but the muſcles as being more voluntary doe worke with a kinde of proportion and meaſure contracting or relaxing more or leſſe as neede requires, and with a diuers motion reſiſting, yeelding to or amending the impulſions and agitations of the aire: thus farre *Aquapendens*. He that deſires further ſatisfaction about theſe muſcles let him looke backe to the 19 Chapter of the eight Booke.

Why theſe muſt needes be muſcles not ligaments

CHAP. XII. *Of the muſcles of the Noſe.*

BEcauſe the motion of the wings of the Noſe is very requiſite in ſodaine & large inſpirations and expirations, therefore Nature hath made them mooueable with voluntarie motion, for which cauſe there are certaine muſcles inſerted into them. For albeit the dilatation and conſtriction of thoſe wings might bee done by the muſcles of the lips which alſo touch them (as alſo the firſt muſcle of the cheeks which is made of the fleſhy membrane [tab. 5. fig. 17] & inſerted into the root of the noſe) yet we haue obſerued in them that haue large noſes called *Naſuti*, ſome muſcles peculiar vnto the noſe it ſelfe, and theſe are of two ſorts: ſome ſeruing for dilatation, others for conſtriction. I am not ignorant what a medly of opinions there is amongſt Anatomiſts concerning the number vſe and ſcituation of theſe muſcles: but I will content my ſelfe in this place to follow *Bauhinus* onely.

Why the noſthrils haue motion.

They are of two ſorts.

The muſcles therefore which ſerue for dilatation of the wings of the noſe are foure, two very ſmall ones which ariſe one either ſide one from the cheeke bone (neare vnto the third muſcle of the lips) & the bony canale or pipe which is neare the noſthrils. Theſe are more fleſhy then ſinowy, and proceede ouer the ridge of the Noſe & are inſerted partly into the outward wing, partly into that part of the vpper lippe which they call *Filtrum*.

Muſcles of dilatation.

The vſe of it is to draw that part of the lip together with the wing of the noſe outward and vpward whereby it alſo openeth the noſthrils. (Tab. 5. fig. 1. F.) For as ſaith *Varolius* becauſe we ſmell by a kinde of Traction, together with the wings of the noſe the noſthrils alſo doe cloſe and are ſomewhat obſtructed; and therefore in ſmelling the holes of the noſe which wee properly call the noſtrils are by theſe dilating muſcles opened and ſo kept.

The vſe.

The two other muſcles doe ariſe with a ſharpe and fleſhy beginning from the ſuture or ſeame of the forehead where they are mingled with the ends of the forehead muſcles vnto the middle of the diſtance between the eys and the ſpine of the noſe: their form is almoſt Triangular, and they deſcend downeward obliquely aboue the bones of the Noſe, where becomming broader they are implanted into the wings, and with their right fibres do draw them vpward and dilate them.

The 2. other muſcles of dilation.

There are alſo foure muſcles which doe conſtring or contract the Noſe, two of which doe ariſe fleſhy about the rootes of the wings, but they are very ſmall: theſe paſſe ouerthwart aboue the wing and imbrace it, and are inſerted at the corner of the noſthrils. The vſe of theſe is that being contracted to their originall they preſſe downe the wing, & ſo ſhut the Noſe, [tab. 5. fig. 2. neere K.] The other two are hid within the cauity of the Noſe vnder the coate wherewith the hole is compaſſed: theſe are very thin and membranous, and doe ariſe from the extremity or end of the bone of the noſe, and are inſerted into the wings; which wings by drawing them inward they conſtringe or ſtreighten, and theſe muſcles as alſo all the reſt in this chapter deſcribed are not found in all, but in ſuch onely as haue large noſes, as we ſaid before. [Tab. 5. fig. 2. vnder. K.]

The foure muſcles of contraction.

CHAP.

CHAP. XII. *Of the common muſcles of the Cheekes and the Lips.*

Foure common muſcles. The ſquaae muſcles.

THE muſcles which are common to the Cheekes and the Lippes are foure, two on either ſide called *Quadratus* and *Buccinator*, the ſquare muſcle and the Trumpeter. The ſquare muſcle [tab.6.fig.1.γ,δ,ε,ζ,η,θ, make the circumſcription,] or as *Galen* calleth it, the muſculous dilatation, or the broade or thin muſcle, becauſe it is large and membranous lyeth vnder the skinne of the necke, and alſo is ſpred ouer the lower part of the whole face from vnder the mouth. It is a membrane encreaſed with fleſhy fibres which yet doe not ariſe from any bone: theſe fibres do aſſend vpward to the middle of the face, creeping by degrees with a variable courſe from the regions of the racke-bone of the necke, on the outſide of the ſame where it ſwelleth moſt, of the ſhoulder blades, of the cannell bones and of the breſt bones, and ſo make abroade and thin muſcle.

Wherefore if any man ſhall deny it the name of a muſcle, and ſay it is but a membrane of muſculous Nature and ſubſtance, or whether he liſt to call it a muſcle, hee ſhall haue my good will, for it is ſo thin and ſo membranous that the ancients did not ſeparate it from the skin but fleyed it off therewith; not accounting it in the number of the muſcles, as *Galen* ſaith who himſelfe was the firſt that deſcribed it, as appeareth in his fourth booke of Anatomical adminiſtrations, and in his firſt book of the diſſection of muſcles, although he knew it not when he wrote his books *de vſu partium*. To this membrane many ſmall branches of nerues are ſent from the ſinews of the neck & mingle themſelues with the fibres; & that is the reaſon why the membrane in this place is more ſtrongly vnited to the parts then in any place almoſt of the whole body, and the ſame diſſemination of the nerues cauſeth thoſe diuers fiberous paſſages which are ſeen in it. For from the breaſt bone and the middle of the clauicle his fibres run right in the length of the necke, [from δ to ζ] and thoſe which beginne from the other parts of the clauicle, from the toppe of the ſhoulder and from the reſt of the parts before named, doe trend obliquely vpward, [from θ to O and H.] and the nearer they are to the ſpines of the racke bones of the necke the more oblique do they appeare: ſo that when they come neare the *occipitium* or nowle of the head they are almoſt tranuerſe: and yet for all that theſe fibres make no interſections in the neck at all, eſpecially that are viſible: but when they come vnto the Chin where the vpper lip is ioyned with the neather, [betweene H. and ζ.] eſpecially at the lower lip they are ſo confounded together that they can bee no more diſtinguiſhed. VVe call it the ſquare muſcle becauſe it paſſeth from the vpper part of the necke by the ſides of the nowle bone away, toward the eare, & is ſomtime implanted with fleſhy fibres into the root therof, by the help of which

The antients before *Galen* knew it not.

Galen found it. The reaſon of the many & diuers fibres in in it.

Why it iscalled the ſquare muſcle.

[*Table 6. is the ſame with that in the Folio* 750.]

fibres in thoſe men who haue this poſition of this muſcle their eares, as we haue ſaid, are moued. Sometime vnder the roote of the eare [O] it paſſeth into the face, and couereth the *Maſſeter* muſcle of the Iaw, and withall groweth more ſtrongly to the Cheeke bone then other where, inſomuch as ſome haue taken this part of it to be the fifth muſcle of the Iaw: and from hence it is inſerted into the roots of the Noſe. The other ſide of it is ouerthwart the face. [from ° by " to ζ.] The third ſide from the top of the ſhoulder to the breſt bone; [from θ by ε to δ] and this ſide is very vnequall and as is it were indented. The fourth ſide to make the quadrature, is from the top of the chinne to the breſt bone. [from ζ to .] Theſe muſcles doe moue the skinne of the face which is not moued by the muſculous ſubſtance of the forehead, the nowle, the eares and the noſe, or by any of their muſcles or by the muſcles of the eye lids: But rather as the right ſquare muſcle draweth and mooueth both the vpper and the lower lippe vnto the right ſide: ſo the left drawes both the lippes obliquely downeward to the left ſide: and becauſe they cleaue faſt vnto the chinne, therefore they helpe much the opening of the mouth. This is that muſcle ſaith *Galen* in his 1. book *de diſſect. muſculorum*, which firſt of al in thoſe that begin to be afflicted with conuulſions is intended or ſtretched, from whence come thoſe conuulſions which we call Cynicke or Dogge-ſpaſmes, becauſe by the contraction of theſe, men are conſtrained to writh and grinne like Dogges.

Their vſe.

The dogge-ſpaſme.

The fibres of this muſcle *Galen* in his firſt booke *de Anatom. Adminiſt.* counſelleth the Chirurgion to be well aduiſed of, becauſe of their inciſions which ſometimes are very neceſſary in this part. For ignorant Chyrurgions not knowing their courſe haue by large tranſuerſe ſections deuided them ſo farre that the cheekes haue flowne upward from the skin vnderneath them.

The

The Muſcle called *Buccinator* (either becauſe it maketh the Cheeke which is called *Bucca*, [ta. 6. fig. 2. M] or elſe becauſe it ſtrutteth in blowing or ſounding of the Trũpet which is called *Buccina*, & therfore we call it the Trumpeter) lyeth vnder the former and comprehendeth all that part which is blowne vp when we ſound a Trumpet. It is round and ariſeth almoſt from the whole length of the vpper Iaw and is inſerted into the length likewiſe of the lower Iaw at the rootes of the Gummes; or if you liſt to thinke with *Columbus* & *Laurentius* it ariſeth from the top of the Gummes, and like a circle doth againe determine into the top of the Gummes. For it being like a circle wherein the beginning, the middle and the end are all one, it skilles not much whether you ſay it proceedeth from below vpwards, or from aboue downewards.

The Trumpeter. His ſcite. His originall. His inſertion,

Thinne it is and membranous wouen with many fibres, from whence come the variety of the motions which it performeth, within and without, aboue and below. To this Muſcle on the inſide, the coat which compaſſeth the mouth groweth ſo faſt that they cannot be diſſeuered but one of them muſt be broken.

The ſubſtãce of it.

The vſe.

The vſe of this Muſcle is whileſt the Iaw reſteth to moue the Cheekes and the Lips, and yet euen in eating when the meate is fallen into the Cheekes, it ſerueth as a hand to reach it againe vnto the Teeth and to driue it hither and thither amongſt them, that the Aliment might be better broken and ſhred, and ſo prepared to bee boyled into Chylus in the Stomacke.

Beſides theſe there is a double vſe of the Cheekes and of their cauities as *Archangelus* hath well obſerued. The firſt, that if any thing in eating doe fall from the Teeth outward it ſhould not be loſt but be kept within the Cheekes: the other vſe is that they might be places of receite to contayne the meate while the teeth bee ready for it; as wee ſee in Apes which fill the puffes of their cheeks with meate which afterward they chew. Moreouer, in man they help much for pronounciation and in winding of a Horne or Cornet and ſounding of a Trumpet; for if theſe cheekes be puſt vp a man may obſerue the diuers motions of this Muſcle by rowling his mouth outward, vpward, downeward, forward and backward.

A double vſe of the cheeks.

CHAP. XIIII. *Of the proper Muſcles of the Lippes.*

THE vſe of the Lippes in all creatures is for Eating and Drinking, and therfore Nature hath prouided their Lippes according tō their Dyet. The Aſſe can mumble a Thiſtle as well as a Man can eate Lettice, whence the prouerbe is, *Similes habent Labra Lactucas*, Like Lettice like Lippes. But becauſe there is another vſe of the Lippes in men, for forming of wordes, for caſting forth of ſpittle and to preſerue the Teeth from the coldneſſe of the Ayre (that I ſpeak not of the ornament which they are to the mouth yea to the whole face) for theſe reaſons I ſay, it was neceſſary that the Lippes ſhould haue voluntary motion, and ſo the inſtruments of the ſame, that is, muſcles.

The proper vſe of the lips in men.

Many of the Ancients and late writers alſo thought that both Lippes were mooued by the onely helpe of the broade Muſcle before ſpoken off, becauſe the great variety of his fibres they thought ſufficient for the accompliſhment of all neceſſary motions in that part. But the more diligent Anatomiſts, beſide thoſe aboue named common to the Lippes and the Cheekes haue found out other proper muſcles belonging to the Lippes alone, about the number whereof they doe not agree. Wee for this time will conclude that they are ſixe, on each ſide two belonging to the vpper Lip, and on each ſide one belonging to the neather.

The opinion of the ancients.

6. proper muſcles of the Lippes.

The firſt paire of the vpper Lip [table 6, fig. 1, ° H] ariſeth from the vtter ſeame of the Iugall or yoke-bone, and that which ſeparateth the firſt bone of the vpper Iaw from the third and from the cheek-bone. In their beginning they are broad and fleſhy, and diſcend obliquely forward, inſerting themſelues into the ſides of the vpper Lippes, which they moue vpward and downward, inward and outward: and that by reaſon of their diuers fibres diuerſly commixed among themſelues and wouen with the skinne: from which notwithſtanding if the body be muſculous or fleſhy and not fat and the workeman diligent, it may be after a ſort ſeparated.

The ſecond paire [ta 6, fig. 1, vnder H] ariſing fleſhy, round and couered with much fat, from the cauity vnder the cheekes; is inſerted into the bridle where the Lips do meet, and they ſay it turneth the vpper Lip downward.

The ſecond paire of muſcles.

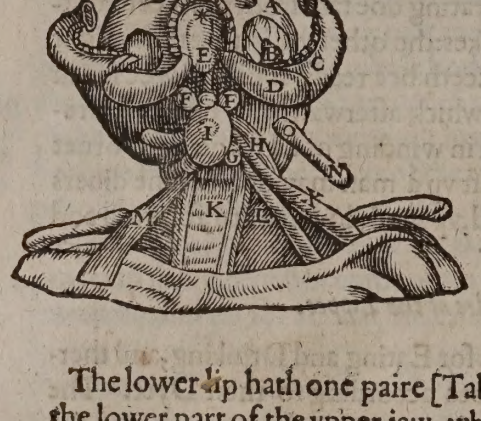
The

Table 7. figure 3. sheweth some muscles of the iaw, the Larynx and the bone Hyois.
Figure 4. sheweth some parts lying in the mouth.

TABVLA. VII.

FIG. III.

FIG. IIII.



A, A hole in the forehead bone, sending a small Nerue into the brim of the seate of the eye.
B. the temporall Muscle.
C, A fungous substance of the lip, together with the nerues stretched on both sides vnto it.
E A hole in the cheeke bending a nerue vnto the face.
G, A part of the yokebone here taken away.
I, the *Massater* or grinding Muscle.
K, A portion of the vii, muscle of the head cut away.
L, the bone *Hyois* bared from a few muscles.
M, the Buccinator or Trumpeter.
m, the vi. muscle of the bone *hyois* according to *Falopius*
O P, the double bellied muscle of the law.
Q, the 2 of the common muscles of the Larynx.
R, the first of the common muscles of the Larynx.
S, A portion of the second muscle of the head.
V, V, 2. Venters or bellies of the 4 muscle of the *hyois*.
X, the fourth Leuator or heauer of the shoulder-blade
Y, the first muscle of the Chest vnder the Coller bone.

Fig. 4. A, A portion of the Temporall muscle.
B, A sharpe processe of the lower Iawe into which the temporall muscle is inserted. * The palate.
C, the left part of the lower iaw.
D, the 4 muscle of the lower iaw lying in the mouth.
E, the *Gargareon* or *Vuula*.
F, the vpper Glandules at the *Vuula*.
G, the lower Glandules at the Larynx.
H, the muscles of the head and the necke mingled.
I, the tongue with the *Epiglottis* or ouer-tongue,
K, the rough artery bared from the muscles.
L, the bed of vesselles neere the Larynx, and the first muscle of the backe.
N, O. The fift muscle of the lower iaw called *Digastricus* hanging from his originall. (necke.
X, the 4 muscle of the shoulderblade arising from the

The lower lip hath one paire [Tab. 4. fig. 2. Z. and ta. 6. fig. 2 *] which ariseth fleshy from the lower part of the vpper iaw, where there is a kinde of asperity or roughnesse at the sides of the chin: thence bending obliquely vpward and becomming broad (for it is broder and shorter then the former paire) are implanted into the middle of the lips, with whose skin as the former they are so mingled, that the Fibers do in a kinde of finger-fold cut betwixt one another.

Their vse.

By the helpe of these Fibres the motions of the lippes become verie Diuers, so that *Galen* writeth in his 11. booke *de vsu partium*. and the second *de Dissec. Mus.* that by these muscles (which yet he would haue to be foure) there are eight seuerall motions effected, foure oblique two in each lip: and beside them foure other right, two altogether right, either when the lips are furthest asunder, the one yeelding vpward to the nose, the other downward to the chin: or when the lips are close ioyned, the vpper being drawn downward, and the lower vpward.

Eight seuerall motions by these muscles

For as in the wrest of the arme right motions are made by the confluence or concurrence of oblique motions, so is it also in the lips: for if the muscle of either side do alone work, that motion is made side-long, but if both of them bee at once stretched, then shall the same lip be after one and the same manner drawne vpward by the vpper muscles & downward by the lower. Thus *Galen* exemplifieth the vse of these muscles in the places last aboue named, to which he that desires more satisfaction may haue recourse, wee will follow our story.

The Corrall of the Lippes

To these muscles before described that fleshy and rude lumpe [Ta. 7. fig: 3, C] and yet musculous may be added, which in the circumference of the mouth maketh the lips both aboue and below, which by some is made a peculiar paire of muscles of the face: we call it if you please the Corral of the lip. *Falopius* diuideth them into two muscles, whereof one garnisheth the vpper lip, the other the lower: and he ascribeth to them as to other muscles their seuerall motions, gathering and wrinkling themselues vp, and with them the flesh of the lippes when we would make our mouthes little.

The Vse of the Corrall.

CHAP.

CHAP. XV. *Of the Muscles of the lower Iaw.*

OF the two Iawes, the vpper as well in man as in all other creatures is immoueable, excepting the Parrot and the Crocodile, the lower is necessarily mooued for the breaking and preparing of our meate, and the articulation of the voyce. The motions of this lower iaw are of two kindes, simple and compound, the simple motions are sixe, and the compound but one. The sixe simple motions are vpward and downeward, to the right hand and to the left, foreward and backewards. The compound motion is made of the right and the left the forward and the backeward, whereby the iawes seemeth to bee carryed round. The motion vpward is performed by the temporall muscle, downeward by the Digastricke; to the right hand and to the left by the first grinder called *Manforius primus*: backeward by the other *manforius* or the muscle that lurketh in the mouth: forward by the fifth paire.

Only the Parrot and the Crocadile moueth the vpper iaw.

Sixe similar motions and what they are

The motion vpward and downeward is to bite, or to share or cut: the motion to the sides whether it be to the right hand or to the left, forward or backeward is to grind; for the meate falleth vpon the teeth of the lower iaw, as vppon the mooving stone of a Mill. For as in a Mill the weight of the vpper stone breaketh the corne vppon the lower: so the meate is ground betweene the vpper teeth which resemble the fixed or immoueable stone of the Mill, and the lower teeth set in the lower iaw which resemble the moueable stone. And therefore these Muscles are called *Molares*, that is, the grinders, and because their act is called Mastication or chewing, therefore they are called *Masticatorij* or *Manforij*, that is, the chewers. VVherefore the Mouth is opened, shut and drawne in compasse by fiue muscles on either side. The first is called *Temporalis*, *Galen de dissect muscul.* 6. calls it *Crotaphita* [tab 6. fig. 1. and 2.ª tab. 4. fig. 2. his circumference is noted by ⁿⁿⁿ. his fleshy part by ꝛꝛꝛ. couered yet with the *pericranium* at °. & the Membrane retracted or drawne backe at ᵖ.] we call it the Temple Muscle, because it is seated in the temples that is in the side of the head at the vpper and forepart of the Eare. This muscle is strong and stiffe, and the largest of all the rest; filling all the cauity of the temple bones. It ariseth [tab. 6. fig. 2.ª *β.γ.*] with a broade fleshy and semicircular beginning or originall from the first bone of the vpper iaw, of the forehead, of the forepart of the scull, of the temples and the *Sphænoides* or wedge bone, and becomes by degrees more fleshy, & growes narrow vnder the yoke bone called *Iugale* which runneth vpon it and about it ouerthwart [tab. 6. fig 2.ᵍ.] and to which it groweth a litle for better defence, and is inserted with a short neruous and exceeding strong Tendon to the sharpe [tab. 7. fig. 4.ᵇ.] processe of the lower iaw imbracing it very firmely with his large armes.

Fiue muscles

The strength of this muscle (by which sometimes a man is able to bite a strong naile in sunder, and we haue known a man therwith to guide a great bell being rung to the height) is caused by his fibres: for all of them as it were from three parts of a circle runne vnto his center, which is to be obserued in the dilatation of the wounds of this part and must sometimes necessarily be made, as also because of the appostemations of these Muscles that the Chirurgion may know how to make incision according to the rectitude of his fibres, least if he wound them ouerthwart, their vse and action should perish, and the life saith *Columbus* with it.

A strange strength of a mans iaw.

A good obseruation for Chirurgions.

The vse of this Muscle together with his fellow is, if they draw directly vpward to lift vp the lower iaw to bind it strongly and to shut the mouth. But if one of them draw alone, then is the traction of the iaw oblique, although *Vesalius* thinketh that this oblique traction is made by three muscles, the temple muscle, the *masseter* or chewer and that that lies hid in the mouth; whence it is that some make three *masseters*, but *Hippocrates* in his book *de Arte*, mentioned but two. This Muscle the Ancients and amongst them *Hippocrates* and *Galen* haue preferred before many others and admired in his composition the wisedome and prouidence of the Creator in making it diuersly according to the diuers vse of the creature.

Vesalius his opinion of the oblique traction of the iaw.

Galen also in his eleuenth booke of the vse of parts and the third chapter, sheweth how these muscles if they be wounded do especially bring conuultions, feauers, deepe and dangerous sleepines, and light frenzies. And *Hippocrates* saith, that the wounds of the temples are mortall. The reason of these accidents may be because they are neare neighbours vnto the braine, there being onely the scull betweene, and that parted by the coronall future or crown seame: as also because of the many and large Nerues which are disseminated through it as *Galen* hath obserued in the former Booke and the seuenth Chapter. This

Hyppocrates.

muſcle hath 3. nerues on either ſide inſerted into him: two from the third coniugation, and the third harder from the fift coniugation to giue him the greater ſtrength, for the more nerues and the harder a muſcle hath, the ſtronger it is to performe his action. No maruell therefore if vpon the wounding or concuſsion, convultion yea death it ſelfe doe follow.

The dangers of the falling of the iaw.

And hence it is that *Hippocrates* thought the luxation of the neather Iaw was oftentimes deadly, becauſe thereby this Muſcle is diſtended, and in his Booke *de articulis* hee ſayth, that vnleſſe the bones of the neather Iaw be ioynted againe after their luxation the life will be in great ieopardy, by reaſon of the continuall Feuers and dull and drowſie ſleepineſſes which follow thereupon: for theſe muſcles if they be altered from their naturall diſpoſition, and intended or ſtreatched are *ſoporiferous*: Wherefore Nature for their better defence hath couered them firſt with a ſtrong, thicke and hard membrane, which is the *Pericranium* or ſcull-skinne, by reaſon whereof the muſcle on the outſide looketh liuid, for his inner part which cleaueth to the bone is altogether fleſhy, becauſe the bone in that place is not couered with the *Periоſtion*. And becauſe a part of the *Pericranion* runneth ouer this Muſcle, ſome haue deſcribed it with two tendons, one inward and another outward.

How nature hath defended theſe muſcles.

The 2. defece

Another defence it hath is this; that the lower part which is neruous is walled with the lugall or yoake-bone, that the nerues (ſayth *Galen* in the 8. Chapter of his 9. Booke *de vſu partium*) ſhould not be hurt, ſo as this bone ſeemeth to haue been made onely for the behoofe of this muſcle.

The third.

Thirdly, the Tendon of this Muſcle is defended aboue and below with fleſh that it might be better ſecured from outward iniuries. The difference of theſe Muſcles according to the variety of creatures is after this manner: Firſt of all in men they are the leaſt and leaſt neruous ordinarily; among beaſtes they are the leaſt in Apes, I meane according to their proportion.

In what creatures theſe muſcles are greateſt.

They are greateſt and largeſt, as alſo moſt neruous in ſuch beaſts as haue their teeth ſet like a Saw, as Lyons, VVolues, Dogges and ſuch like. There are other creatures wherein they are very large but not ſo neruous; large not ſo much for the ſtrength of the action, becauſe thoſe great creatures doe feede moſtwhat vppon the earth, but that they might bee proportionable to the magnitude of the lower Iaw; ſuch are Aſſes, Horſes, Oxen, Cammels and ſuch like, as we may reade at large in *Galens* eleauenth Booke *de vſu partium* and the 2. Chapter.

In what creatures leaſt.

They are leaſt in men both becauſe our neather Iaw in reſpect of other creatures is the very leaſt, and beſide, becauſe our teeth are giuen vs only to breake our meate and for no other vſe: for a mans fortitude conſiſteth not in the ſtrēgth of his Iawes, neither doth hee thereby curbe and keepe in awe the other creatures but by reaſon and by his handes. Notwithſtanding they are the greateſt of all the muſcles of the Iaw, becauſe they almoſt ſuſtaine it and lift it vp as if it hung and depended only vpon them.

Why leaſt in men.

The 2. muſcle of the lower iaw called the grinders

The ſecond Muſcle of the lower Iaw is called *Maſſorius primus, Maſſeter & molitor*, names all taken from the vſe of the Muſcle which is called *Manducation* or chewing, and therefore wee may well call it in our Engliſh the Chewing or the grinding muſcle. His poſition is in the Cheeke [tab. 6. fig. 2. and tab. 7. fig. 3. I ta. 4. fig. 2. V] and it hath a double head, one neruous proceeding from the ball of the cheeke [tab. 6. fig. 2. λ] vnto the future where the Iaw-bone meeteth with a part of the lugall or yoake-bone, and paſſeth along vnto the vtmoſt angle of the Iaw which wee call his acute or ſharpe proceſſe; the other head is fleſhy and paſſeth from the yoake-bone [ta, 6, fig, 2, κ and ta, 7. fig, 3, at °] toward the chinne, and is implanted very ſtrongly [table 6, figu, 2, μ] with a broad inſertion to the whole latitude of the lower Iaw, ſo as it repreſenteth, ſaith *Galen* in the 4. chapter of his 11. Booke *de vſu partium*, the corner of a blunt or obtuſe triangle, the top whereof is neare the ball of the cheek, [λ] one ſide toward the end of the yoake-bone [from λ to κ] another ſide toward the lower Iaw [from κ to μ], and the third and laſt as it were a Baſis ioyneth both the forenamed ſides to all the parts of the lower Iaw, being extended or ſtreatched according to his length.

His fibres.

The Fibres of theſe heads do interſect themſelues like this figure χ, and thence it is that they moue the Iaw as well on both ſides as alſo forward and backeward (for there is a diuers motion required in chewing or grinding the meate) and in compaſſe: for as the vſe and action of the temporall muſcles was vehemently to ioyne the teeth & the two iawes together, and ſo to breake whatſoeuer ſhould light between them: ſo the action of theſe

chewing

chewing or grinding muſcles is to leuigate or ſhred ſmall the meate that is before broken by the temporall muſcles. To this action the tongue doth not a little helpe, which like a hand turneth and returneth the meate in the mouth that all his partes may come vnder the Breake; which motion of the tongue is performed by a muſcle of the Tongue called *Linguæ Maſticator* or the Tongues Chewer, and not onely ſo, but alſo the muſcles of the cheekes are of great vſe toward the performance of the foreſaid worke.

The third payre of muſcles [Tab.7,fig.4.neere to ᵖ] is ſituate vnder the temporal muſcle in the lower part of the cauity of the Temple bones, and taketh his beginning partlie from the vpper and vtter parts of the proceſſes called *Aliformes* or like vnto wings which are ſharpe and vnequall; and partly from the roofe and ſharpe top or height of the bone called *Sphenoides* or the wedg-bone, which in the cauity of the temples looketh directlie againſt the yoke-bone, where it hangeth ouer a large rift made by the ſame *Sphenoides* & the greateſt cheeke-bone. The 3. paire of muſcles of the lower iaw

The originall or head of this muſcle is partly neruous and partly fleſhy, and hauing gotten this fleſhineſſe it is led obliquely backeward and is inſerted into the necke of the lower iaw, and into the inſide of his head. His vſe is to mooue and lift forward the Iaw, as the next that followeth mooueth it backeward.

The fourth muſcle is another *Manſorius* which *Galen* in his fourth Booke of Anatomicall adminiſtrations the fourth Chapter and diuers other places, calleth the muſcle lurking in the mouth, [Tab.7.fig.4 O] becauſe it lyeth hid in the great boſome of the inſide of the Iaw. This muſcle is thicke and ſhort, and ariſeth very neruous from the inward cauity or hollow pipe of the wingy proceſſes of the wedge-bone called *Sphenoides*; afterward becomming fleſhy, large and thicke it deſcendeth with right fibres, and is inſerted with a ſtrong neruous and broad tendon to the inner and backe-part of the lower Iawe where the roughneſſe is, and where the boſome or hollownes is faſhioned that it might not take vp too much roome about the Almonds of the throate. And this muſcle (ſayth *Galen*) helpeth the temporall muſcle to which it groweth ſtrongly neere the production and inſertion of his tendon; for it draweth the Iaw inward and vpward, and ſhutteth the mouth, becauſe it is a matter of labour to draw a heauy thing vpward, and to breake and grinde a hard ſubſtance: beſides when the Iaw is brought forward it draweth it backward againe. The 4. muſcle of the lower Iaw.

The fift Muſcle called *Graphioides* or *Digaſtricus*, double bellied [Table 7 figure 3, °ᵒ and figure 3, ᴺ° Table 6. figure 2 °] is thinne and ſmall, ariſing membranous and very broade from the Apendixe called *Styloides* (from whence *Galen* called it *Graphioides*, becauſe the Ancients vſed to write vpon waxen Tables with a Probe which they called *Stylus*) and immediately becommeth fleſhy and round and paſſeth vnder the lower part of the vpper Iaw and the eare, and in the middeſt where it is curued or crooked at the turning of the lower iaw it looſeth his fleſh and becommeth Neruous: and againe recouering his fleſh is inſerted into the middle of the iaw faſt by the lower part of the chin, where the inner bone becommeth a little rugged for his better inſertion, and where both the Muſcles of each ſide do meete; albeit about his middeſt it cleaueth to the bone called *Hyoides*. There is alſo in this place a kinde of forme of a Pulley; for becauſe theſe Muſcles do not ariſe from the lower parts of the necke but rather from the vpper, they could not mooue the Iaw downward vnleſſe they had bene wound about the lower angle of the lower Iaw, as it were about a Pulley. The Fyfte and laſt muſcle of the lower iaw. His variable ſubſtance.

The vſe of this paire of Muſcles is to draw the Iaw downward, & ſo to open the mouth and by conſequence to draw the tongue toward the throate: but if one of them onely do moone, it leadeth the Iaw obliquely to his owne ſide. It was called *Digaſtricus* becauſe it hath two Venters or Bellies, being fleſhy in the beginning and in the end, and in the middle [Tab.7.fig.3 betweene ° & ᵖ fig.4.between ᴺ and °] neruous or tendinous (which is peculiar to this and to the ſecond paire of muſcles of the bone *Hyoides* [tab.7.fig:3, V, V] and to the fift proper paire of the Larynx or throttle) partly for more ſtrength, partly that it might not take vp too much roome becauſe the place is but narrow, and there are many Inſtruments to fill it vp, eſpecially the muſcles of the tongue and of the *Hyois*: and therefore alſo they were made ſmall and thin, round and long, their motion beeing but eaſie. for the Iaw fals downward with his owne weight, and therefore needed no ſtrong retractor. The vſe of theſe muſcles tog ther. What muſcles haue 2 bellies

Finally, becauſe a part of the ſquare muſcle (which with *Galen* we reckoned among the muſcles of the cheekes) groweth more ſtrongly to the bone of the lower Iawe, the right and The reaſon of *Arantius* his opinion.

and the left meeting at the middle of the chinne to draw the ſame downward; therefore *Arantius* (who did not acknowledge the third paire aboue named) maketh it the fift paire of the Iaw, and ſayeth, that this portion or part of the ſquare muſcle together with the 4. paire called the *Digaſtricks*, do open the mouth and draw the Iaw downwards, yet ſo, that it is more directly drawne (without the motion of the cheekes) by the fourth paire; but by this fift paire as he accoũteth them, the iaw is wreſted obliquely together with the cheeks and the lovver lip ſide-vvard if but one of them moue; if they mooue together, then it inclineth it to neither part but leeadeth it tovvard the throttle.

The vſe that *Arantius* limitteth.

CHAP. XVI. *Of the Muſcles of the Choppes which ſerue for Diglutition or Swallowing.*

Galen firſt of all men deſcribed the muſcles of the Choppes, whome after *Oribaſius* his *Epitomizer* and *Auicen* followed, making one on each ſide. Among the later Anatomiſts *Falopius* was the firſt who deſcribed three paires; which are ſeated in the Mouth betweene the coat of the palate & the bredth of the Noſethrils. VVe will reckon vnto you 4. paire, whereof two doe dilate and tvvo contract; and therefore they helpe the Svvallow becauſe the Chops vvere of neceſsity to bee dilated or ſtraightned vvhen the meate and the drinke ſhould paſſe by them.

4. paire of muſcles of the chops.

The firſt paire ariſeth thinne and neruous from the toppe of the vvedge-bone called *Sphænoides* neare the articulation of the lovver iavv vvith the bone of the temple, and deſcendeth very ſmall and ſlender by the invvard cauity of the *Pterygoides*, and endeth in a neruous thinne and broad tendon vvhich paſſeth ouer the cleft vvhich is in the end of the *Pterygoides*, and being reflected is inſerted into the skinny part of the palate at vvhich the *Vuula* hangeth. If both theſe muſcles moue together they dravv the bottom of the chops, together vvith the *Vuula* vpvvard and forvvard; if but one of them moue, then it dravveth vnto that ſide vvherein it is ſeated.

The firſt.

The ſecond paire ariſeth neruous from the ſame beginning vvith the former, and declining dovvnevvards it is inſerted into the ſides of the choppes vvhere the Tonſils or Almonds doe reſide and taketh vppe or at leaſt embraceth all the ſide and backepart of the Choppes This payre draweth the Tonſils vpward and ſidelong, and dilateth the whole cauity of the Chops by parting them aſunder. Theſe two paires ſerue to dilate or open the Choppes, and ſome ſay they hinder the liquid matter that comes vp in vomiting that it paſſeth not through or into the noſe.

The ſecond.

The third paire compaſſeth the backeward and ſide cauitie of the Choppes, and ariſeth very thinne where the head is ioyned with the necke, whence it deſcendeth and is inſerted in the ſides of the bone *Hyois* and the firſt griſtle of the Throttle, ſometimes alſo into the roote of the Tongue but obſcurely; and it conſtringeth the Choppes when a man ſwalloweth; and as *Falopius* perſwades himſelfe it helpeth to ſwallow *a great morſell*; becauſe in diglutition or ſwallowing of meat it raiſeth vp the throttle.

The third.

The fourth paire ariſeth very ſlender from the inſide of the appendix called *Styloides*, declineth forward, and is inſerted with a membranous Tendon to the firſt Griſtle of the *Larynx* or Throttle, to the ſides of the bone *Hyois*, and the extremity of the rootes of the Tongue: and therfore (ſayth *Platerus*) it may be ſayd to be a paire common to the chops and to the Tongue, becauſe it draweth the tongue and the foreſayde parts backwards and vpward, and conſtringeth the choppes as wee ſwallow. Theſe two latter paire doe contract the choppes and ſomewhat lift vp the throttle that the ſwallow might bee the more facile and eaſie.

The fourth.

CHAP. XVII. *Of the Muſcles of the Bone called Hyois.*

BEcauſe the meate when it is broken by both the Iawes and their Teeth, by the helpe of the Muſcles of the Cheekes, the lower Iaw and the Tongue, muſt bee ſwallowed and tranſmitted into the Stomack; and that this diglutition or ſwallowing is a voluntary motion, it had neede of Muſcles appropriated thereunto and diſtinct from the muſcles of the Tongue, becauſe wee can ſwallow and yet hould our tongues ſtill and ſtedfaſt: and beſide, the muſcles of the Tongue doe accompliſh other priuate motions of their owne.

Theſe Muſcles which ſerue for diglutition they make to be proper to the bone *Hyois*, both

both becauſe they are annexed vnto it, and do alſo mooue it vpward and downward, and to both ſides; for the bone it ſelfe was neceſſarily to be mouable, becauſe it was ordained to be helpeful to deglutition. But there are two kinds of muſcles which are ioyned to this bone: ſom haue their original frō it but do ſerue other parts, as the tongue & the Larynx. Others that take their originall from other bones, and yet are inſerted into this *Hyois* and are proper to it, and of theſe we will intreate at this time, reckoning vp vnto you 4 payre although there be ſome who account ſixe. Foure paire of Muſcles.

Of theſe two, paire are numbred with the muſcles of the tongue, becauſe the motions of the tongue and of the bone Hyois are very nere a kin, and therefore it is no wonder if their muſcles be mixed and connected together.

The firſt paire run betweene the breſt-bone and the bone *Hyois*, and are therefore called *Sternohyoidei* [Tab. 6. fig. 2 ☿ R] and appeare outwardly vnder the skin lying vppon the ſharpe artery and the griſtle of the throttle called *Thyroeides*. It ariſeth with a broad and fleſhy beginning from the vpper and inner ſide of the breſt-bone, and runnes directly vpward, and is implanted very fleſhy without a tendon (ſaith *Columbus*) into the foreſide of the baſis of the bone *Hyois*. All along their paſſage they are fleſhy and broad, and are diuided in the middeſt by a line which paſſeth according to their length. Their vſe is to draw the bone ſtraight downward and backward, and by accident alſo they defend the throtle and the griſtle *Thyroeides*. The 1. paire.

The ſecond paire called *Genio-hyoidei* [Tab. 6. fig. 2 S] are vnder the chinne, and the fift paire of the lower iaw. [Tab. 6. fig. 2 O] They are large and ſhort and fleſhy all ouer, and do ariſe with Fibres of a diuers courſe from the inner part of the lower iawe, and are inſerted with the ſame breadth into the middle part of the bone Hyois, into which alſo the firſt paire was implanted. They draw directly vpward and ſomewhat forward. The 2. payre.

The third paire called *Styloceratoeidei* [Tab. 7. fig. 2 T] is ſeated obliquely and vnder the Chin as the former, and are outwardly ſtretched vppon the fifte paire of the neather Iaw. They are ſlender and round, and ariſe from the roote of the Appendixe *Styloides* aboue the originall of the fift muſcle of the Iaw, and end into the hornes of the *Hyois*, that is, into the laterall or ſide parts thereof, and they are ſometimes perforated in the middeſt to giue way to the muſcle which openeth the Iaw. They moue the bone toward the ſides and ſomewhat vpward. The 3. paire.

The fourth paire is called *Coracohyoeidei*. [Tab. 6. fig. 2. V, V. Tab. 7, fig. 3, V, V] They ly lurking vnder the fourth muſcle of the ſhoulder-blade, as *Veſalius* and *Platerus* haue noted. They are ſlender and long, and do ariſe out of the proceſſe called *Caracoeides* at the vpper end of the ſhoulder-blade nere his necke, and do run obliquely vpwarde vnder the ſeuenth muſcle of the head, and are implanted where the third paire is, into the beginning of the lower proceſſe of the bone *Hyois*, and theſe draw downward vnto the ſides. This is a long paire, on eyther ſide fleſhy and hath a double belly, and therefore *Galen* cald them *Digaſtricks*, but in the middle they are ſlender and neruous as is the fourth muſcle of the Iaw and the fift proper muſcle of the Larynx, and extenuated into the forme almoſt of a Tendon, haply to giue way to the ſeuenth muſcle of the head, which heere runneth ouer him [K] as to his better. The 4. paire.

Concerning the vſe of theſe muſcles, we craue leaue to add yet a little more: ſome thinke they were not ordained for motion but rather for tenſion, to tye, eſtabliſh & ſuſpend the bone *Hyoides*, ſo ſaith *Laurentius*: others as *Archangelus* thinke, they ſerue for deglutition, and that they are the proper muſcles of the *Hyois*. Others as *Arantius*, becauſe this bone is the baſis of the Tongue, and becauſe the baſis of any thing can by no meanes be mooued, but that alſo muſt be moued which is eſtabliſhed vpon that baſis, do thence determine that theſe muſcles do mooue the Tongue, and ſo much the rather becauſe the manifold and frequent motions of the Tongue can hardly be imagined to be accompliſhed by ſo few and ſo ſmall muſcles as determine or end in the ſubſtance of the Tongue. Wherefore theſe may be called the common Muſcles of the tongue and the *Hyois*, into which certaine Nerues are diſtributed from the ſixt Coniugation. An addition concerning the Vſe of theſe muſcles *Laurentius*. *Archangelus*. *Arantius*.

CHAP. XVIII. *Of the Muſcles of the Tongue.*

THe tongue hath three ends in Nature; to ſpeake, to taſte, and to rowle the meate in the mouth, which cannot bee performed without motion, and therefore Nature hath allotted vnto it Muſcles, which from thoſe three actions may bee called, the Three vſes of the tongue.

Talkers, the *Taſters*, and the *Rowlers* of meate. In man the eſpeciall end of the creation of the tong and of the motion of the ſame is for ſpeech, as in beaſts for taſt.

The eſpeciall vſe in man.

For becauſe they want hands wherwith to reach their meat or fother vnto their taſt, it was neceſſary they ſhould be able with their tongues to lick and gather it of the earth: but man is able to taſt without the motion of the tong, becauſe he hath hands wherewith to bring that he would taſt vnto the inſtrument or organ of the ſence: but both of them haue neceſſary vſe of it in rowling and returning the meat againe vnto the teeth which falleth from them into the ſpace of the mouth.

VVherefore that it might anſwer thoſe intentions, it was made moueable and had therfore muſcles, and not muſcles onely, but alſo a figure fit for motion, ſome parts being thinner then other: yet becauſe it ſhould not moue beyond his teather, Nature hath reſtrained it with a ligament, that the body of it which by reaſon of the diuers fibres it had was infinitely diſpoſed to motion and agitation, might rowle vpon that axletree, or turne vpon thoſe hinges onely: but of theſe things we haue ſpoken ſufficiently heretofore, excepting of the muſcles whoſe proper place this is.

The bridle of the tongue.

The Muſcles therefore of the Tongue are double, ſome are common, others proper. Thoſe are eſteemed to be common, which haue already bene ſaid to belong to the bone *Hyois*, vnto which the third paire alſo now to be mentioned may happily be referred: and thoſe proper which hauing their original other where, do determine and end in the ſubſtance of the Tongue.

Muſcles of the tong double.

The firſt paire are called *Styloglоſſi* or the Auger-tongue Muſcles [Tab. 8. fig. 1 & 2] *Galen diſſect. muſcul.* 14 calleth them πλαγιοι, that is tranſuerſe. They haue ſlender originals from the vtter face of the Appendix *Styloeides* (as the fourth paire of the throat from the inſide of it) and are implanted with tranſuerſe fibres into both ſides of the Tongue about the middle thereof, yea they proceede forward and attaine vnto the top of the Tongue; and when the Tongue is lilled out they draw it in againe. But becauſe their Fibres are ſo wouen one within another, when both of them are at once contracted toward their originall they lift the tongue directly vpward, but when one of them onely worketh then is the tongue lead vpward to one ſide onely.

The 1. paire.

[*Tab. 8. is the ſame with that in lib. 8. Fol. 643.*]

The ſecond paire are called *Myloglоſſi* or the *grinder-tongue* Muſcles [tab. 8. fig. 1. and 2.c.c.] They ariſe with abroad and inuerted originall and tranſuerſe fibres from the ſides of the lower iaw neare the roots of the grinding teeth called *molares*; and are inſerted on both ſides into the length of the ligament which is vnder the baſis or foundation of the tongue, and degenerateth into the bridle by which the tong is tyed to the Chops. When one of theſe workes we turne the tongue vpward and obliquely, but when both of them mooue, then the tip is directly lifted vpward to the palate and vpper teeth. Sometimes this paire doubleth the tongue or maketh it hollow like a gutter, and ſuſtaineth it ſo in forme of a compaſſed bow to the palate with the aſſiſtance of the ligament and bridle becoming ſomewhat rigide or ſtiffe. And if the ſecond paire belonging to the bone *Hyois* doe worke with them, then the tongue becommeth more narrow and ſolid and is exerted or thruſted forth to his extent beyond the lips.

The 2. paire

The third paire are called *Genuoglоſſi* or the *chin-tongue* Muſcles [tab. 8. fig. 1. and 2 e.] They ariſe with a narrow beginning from an aſperitie or roughnes in the inſide of the middeſt of the Chin; afterward they become broader and repleniſhed with right fibres, & are implanted into the middle of the tong the greateſt part of them at the roote, yet ſome part of them runs out toward the tip, ſo that the diuers parts of the ſame Muſcle do worke contrarily. For the greateſt part of their fibres beeing drawne toward their originall thruſt the tongue beyond the teeth and the lippes, (although *Auerrhoes* thought that a proper motion of the tongue) the leſſer part in their action draw it againe inward. Sometimes they communicate ſome fibres to the bone *Hyois* which they ſo draw vnto the chin. They haue alſo certaine lines in them which Anatomiſts call *inſcriptions* as if they were many Muſcles.

The 3. paire.

Their contrarie vſes.

The fourth paire are called *Baſigloſſi* or *Ypſigloſſi* or *bone-tongue* Muſcles. [tab. 8. fig. 1. and 2.p.p.] Theſe doe ariſe ſtraight fleſhy from the vpper and middle part of the bone *Hyois* and in ſome places are obſcurely diuided aſunder, as if they were many muſcles, and ſo run a long the length of the tongue, and are inſerted in the middeſt of it. Their vſe is when they are contracted to draw the tongue directly inward or backward toward his roots.

The 4. paire.

The

The fifth paire are called *Ceratogloſſi* or *horne-tongue* Muſcles [tab.8.fig.1. and 2.ª.] and ariſe from the vpper hornes(if they be there)of the bone *Hyois*, from whence paſsing ſomewhat obliquely or ſloping they are inſerted into the ſides of the tongue neare vnto his root;ſometimes they ariſe from the neather hornes when the vpper are wanting,or are not very bony,but rather like ligaments;which as wee haue ſayd is moſt commonly in women which haply makes their tongues more plyable. If one of theſe onely be contracted the tongue,eſpecially the roote of it, is drawne ſide-long downeward, and ſo it may bee ſayd to mooue to the right ſide or to the left: but if both of them be contracted then is it mooued right downeward toward the throate; this paire in Oxen is double, in men it is but ſingle. The 5. paire.

Theſe fiue paire of Muſcles therefore do moue the tongue vpward, downeward, foreward, backeward, on the right hand and on the left hand,or to the ſides; but if they worke ſucceſſiuely,that is,one vpon another,then they turne the tongue round;& all theſe motions the muſcles of the bone *Hyois* do not a little further,which ſome do rather aſcribe to the fibrous ſubſtance of the Tongue,which hath indeed all three kindes of fibres. The ſubſtance of the Toung.

At the roote of the Tongue when theſe Muſcles are remooued there appeareth a certaine fleſh compounded of many Glandules mingled with fat, which fleſh doeth not merrit the name of a muſcle,becauſe a Muſcle doeth not conſiſt of glandules or kernelles but of fleſny fibres.[tab.8,fig.1,and 2,ª.] This knot of glandules groweth at the roote of the Tongue that with their liquor it might alwaies bee kept moyſte, becauſe without moyſture there can be no perfect taſte,no more then there can be any concoction in the Stomack without Elixation or boyling,for the concoction of the Stomacke is not a roaſting but a boyling or elixation; & therefore Nature hath ordained the Glandulous *Pancreas* or Sweet-bread to touch the Stomacke,that thence there might continually aſcend moyſt vapours that the concoction of the ſtomacke might be accompliſhed by a moyſte boyling,not by a dry roaſting. The glandulous fleſh at the roote.

Moreouer,this moyſture of the kernelly fleſh maketh the motion of the Toung more glib and glad as wee ſay,or nimble; for when the Tongue is dry (as vvee may perceiue in thoſe that are exceedingly a thirſt) his motions are more ſlovv; the ſame alſo vvee haue experience of in thoſe that labour of burning Agues, in vvhome all the moyſture of the Tongue is exhauſted and dryed vp. Moreouer,the Almonds of the Throate which we call *Tonſillæ*, as is before obſerued by yeilding a perpetuall moyſture, doe moiſten the Tongue and ſo further his motion.

CHAP. XIX. *Of the Muſcles of the Larynx or Throttle.*

BEcauſe the actions of the Throttle or *Larynx* are performed with voluntary motion,Nature hath giuen it muſcles,which by their action which is Contraction might bend,extend and moue ſidelong the ioynts of the griſtles, that ſo the *glottis* or Toung-let might become mouable and his cleft might be made broader or narrower as need ſhould require:for ſo it behoued to be, becauſe it was conuenient that our voice as well as our ſpeach ſhould be at our commaund. The Throttle therefore hath two kindes of Muſcles,Common and Proper. The Common are ſixe, (or three paire)of which foure doe conſtringe and two do dilate it. The Common are ſo called becauſe they ariſe from other partes, and are but implanted into the Throttle; and of theſe wee will treate firſt,becauſe they firſt fall vnder our view and ſo come firſt to be ſhewen. The action of a muſcle is Contraction. 3. paire of common.

The firſt paire of the common Muſcles [tab.9.fig.7.x x] which *Veſalius* and diuers others do make the ſecond,is ſituated in the forepart of the Throttle, one on each ſide,and we call them *Bronchios* or the weazon Muſcles,becauſe they cleaue to the rough artery all along,which is called βρόγχος by *Hippocrates*. For they ariſe with a fleſhy and broade beginning from the vpper and inner part of the Breaſt-bone at the very *Iugulum* aboue the clauicles,and with right fibres doe runne vp along the weazon fleſhy and a little broader then where they aroſe,& are inſerted into the ſides of the ſhield-griſtle called *Thyroeis*,below neare the Glandules with a broade and fleſhy Tendon; which in man is but one, but in beaſts it is deuided in the middeſt,& in moſt of them one part is faſtned into the throttle,the other into the bone *Hyois*. Yet *Galen* is of opinion that this is their originall,and that they are inſerted into the breſt-bone. The firſt paire.

They are very long,becauſe not the ſhield-griſtle or the *Thyroides* only, but the whole

Larynx

Larynx is moued eſpecially in a baſe voice, where the throttle mooueth downeward, and the whole weazon is contracted in his membranous diſtances, and therefore it was, that this paire cleaueth to the whole length of it.

They are moreouer very ſlender, becauſe the throttle eaſily deſcending with his own waight did not require any great ſtrength: yet notwithſtanding they haue certaine inſcriptions or neruous diſtinctions, ſuch as are in the right muſcles of the paunch, by which their length and tenuity is ſecured from danger.

Their vſe is to draw down the ſhield-griſtle called *Thyroides*, and below to conſtringe or contract it, and ſo to dilate the cleft or fiſſure of the *glottis* or toung-let in a baſe voice; they alſo doe ſomewhat contract the weazon, that it be not doubled when wee ſpeake, or the throttle too much dilated aboue.

The 2. paire, The ſecond paire of Common muſcles [ta.9.fig.3.[h]] which *Veſalius* cals the firſt paire as alſo doth *Falopius* and ſome others; is ſituated likewiſe in the forepart of the *Larynx* or throttle, and are called *Hyoeides*, or rather *Hyothyroeides* or the ſhield-bone muſcles, theſe are oppoſed to the former and are farre ſhorter. They ariſe broad and fleſhy almoſt from all the lower part of the bone *Hyois*, to whoſe inward ſides they ſeeme to be continuated; and with right fibres they creepe downeward together, ſauing that their inner ſides doe depart one from another, and are each of them implanted with a broad and oblique end into the lower part of the Griſtle *Thyroeides* which they wholly couer. Their vſe is to dilate the lower part of the ſhield-griſtle and to contract his vpper, & by drawing the throttle vpward to make the cleft ſhorter and narrower; ſo we may perceiue that in an acute or ſhrill voice the throttle moueth vpward; but if this muſcle doe proceede obliquely backward as often it doth, then it mooueth the ſhield-griſtle or *Thyroeis* vpward and forward. I can giue no better reaſon of their ſhortneſſe, but becauſe the Larynx hath other helpes to draw it vpward beſide theſe: for the bone *Hyois* being mooued vpward by other Muſcles, draweth the whole throttle vpward with it.

Tab.9. The ſame with the xv. Lib.8. Fol.635.

The 3 paire. The third paire of common Muſcles [Tabl.9. fig,7 [11]] are ſeated in the backe part of the Larynx, they are called *œſophagæi* or the Gullet muſcles, and truely ſome thinke they are muſcles of the *œſophagus* or Gullet and not of the Throttle or Larynx, becauſe they encompaſſe the gullet on euery ſide and are thought to helpe much in diglutition. They *Laurentius.* are altogether fleſhy and large, and do eſpecially lye vpon the vpper part of the Gullet, which they encompaſſe ſaith *Galen* like a ſphincter, three fingers bredth ouerthwart, and do almoſt cleaue vnto it.

They ariſe from the ſides of the Shield-griſtle or *Thyrois* all along, where there appeareth a rough line, and paſſe aboue the gullet with their Fibres almoſt tranſuerſe, and there in their extremities or ends they meet, yet ſo that they are diſtinguiſhed by a white line running through their length, eſpecially in beaſtes, for in a man it is oftentimes not viſible, & beſide the Fibres do not ſeeme to be diuided, ſo as they may eaſily be taken for one muſcle. Their vſe is, as they contract the ſides of the Shield-griſtle or of the *Thyrois*, ſo to compreſſe it to binde and ſtreighten the cleft; but as they encompaſſe the gullet & are drawne into themſelues, ſo by a voluntary motion they helpe the ſwallowe, and are ſomewhat aſsiſtant to the naturall Faculty as we haue partly opened before. And thus much of the common muſcles of the throttle, now follow his proper.

Proper Muſcles. Of proper muſcles there are ten (or fiue paire) ſixe of them do dilate, and foure contract; they are called *Proper*, becauſe they both ariſe from the Larinx to which they grow, and againe are inſerted into it, imploying all their ſeruice to it alone, opening the cleft in inſpirations or when we take in breath, and ſhutting it when we breath out; beſides they faſten together the two Cartilages or griſtles, which do originally and of themſelues helpe the forming of the voyce. Of theſe muſcles ſome are before, ſome behinde, others without others are placed within.

The 1. paire The firſt paire of the proper [tab.9.fig 4.[f] but in the ſixth figure one of them is ſeparated, the other remaineth in his place,] which are forward and vttermoſt we cal *Antiei Crycothyroidei* or the forward *Ring-ſhield* muſcles: their ſituation is in the lower and forepart of the *Originall.* Larynx, they ariſe from the Cartilage cald *Crycois* or the Ring fleſhy (but ſmall and hauing oblique fibres) & proceed obliquly til they be implanted into the Baſis of the ſhield-griſtle or *Thyroeides* withinward, & in their whol progreſſe (their middle part only excepted) they

are fleſhy

fleshy and broade: and if you seperate the lower processe of the shield-gristle or *Thyroides* from *Crycoides* or the Ring and follow it with a section, you shal perceiue that there is one in each part.

The vse of these is to moue the *Thyroides* from aboue downward, to ioyn it to the *Crycoides*, to constringe the lower part of *Thyroides* and to dilate the vpper part, and by that meanes to open the *glottis* or cleft of the *Larynx*.

The second paire are called *Crycoarythenoidei postici*, the backeward Ring-Ewer muscles. [tab.9.fig.5.f] Their situation is in the backside of the Ring-gristle and they arise narrow and fleshy from the lower and backe partes of the same gristle, and running vpward [ta.9.fig.5.f] do fill a smooth cauity made for their sake in the backside of the Ring-gristle which looketh toward the Gullet or *Oesophagus*; and at length becomming more large & strong with fibres somewhat sloping or oblique, they fall from the spine or rough line of the Ring-gristle, and are inserted on both sides neruous into the lower part of the Ewer-gristle where it is articulated with the Ring-gristle. The 2. paire.

The vse of these is to turne the third Gristle backeward to the outside of the *Larinx*, to open the cleft and dilate it to the sides, and so they further the base voice. But as they haue both right and oblique fibres, so they serue for diuers and mixed motions; with the right they draw the cleft backeward and so open it; with the oblique they helpe to moue toward the sides; so that they open and enlarge the cleft both in the length and in the bredth of it. The vse of their double fibres.

The third paire are called *Crycoarthenoidei laterales* or the side Ring-ewer muscles. [tab 9.fig.4. r.] Their originall is fleshy from the Ring-gristle where it is brodest, from whence they proceede directly vpward, and become larger and more fleshy, & are inserted to the sides of the Ewer-gristle at the articulation or ioynt, and do occupy all the roote of the third gristle which the former paire do not touch. The 3. paire

Their office is outwardly to sunder the double Ewer-gristles, and to separate them one from another so much as the fifth paire drawes them together, and by that meanes they driue out the sides of the cleft and open the throtle. But because these muscles are seated, partly without, and partly within the capacitie, happily on the outside they binde or contract the Larinx.

The fourth paire called *Thyroidei interni*, the inward shield-gristle, or *Thyroarthenoidei*, that is, the shield-ewer muscles, [tab.9.fig.4.^{c}.tab.8.fig.1.$^{c\,c}$.] are broade, fleshy, and haue diuers fibres mingled and vnited together, and in their beginning three inscriptions or distinctions as if they were three seuerall muscles, and are seated ouerthwartwise, in the capacitie of the Larinx or throtle. They arise close one to the other from the inner, hollow and middle part of the shield-gristle (whose inward cauity they fil) along the whole length of it, and with oblique fibres they ascend vpward, growing narrower in the ascent, and are inserted into the sides of the ewer-gristle which forme the rongue-let or *glottis* following the sides of the cleft. The 4. paire.

These are the largest and strongest of all the proper Muscles and almost equall all the Muscles of the throttle put together, and that for good reason, namely because in the retaining of the breath they were to resist all the Muscles of the Chest. For in drawing the parts of the Ewre-gristle vnto the Shield-gristle, and in constringing them or gathering them together and thrusting the tongue-let forward, they shut it vp and are said to close the throtle. If in these Muscles there happen an inflāmation it bringeth a mortal squinnasy there appearing no redness neyther in the chops, nor in the mouth, nor in the necke. For in the squinsie sometimes the brest-bone, sometimes the necke looke red; the brest-bone because of the continuity of the weazon muscles, which wee saide did arise fleshy from the vpper and inner side of the brest-bone and ran all along the weazon, and were inserted into the Shield-gristle. The true and dangerous squinanie.

The sides of the necke become red, because of the Gullet Muscles which arising from the sides of the Shield-gristle doe encompasse the whole gullet like a sphincter: also the fore and vpper part of the neck looketh red, because of the continuity of the Shield-bone Muscles which arising from the bone *Hyois* are inserted into the lower part of the Shield-gristle couering the same wholie.

The fift and last paire called *Arytenoidei* or the Ewre-Muscles [Tab.9.fig.4 and 5^{t}] are scituated outward and backeward aboue the gristle where it resembleth the figure of an Ewre or Water-spout, and where the gullet is ioyned to the throttle, and the third gri- The 5. paire.

stle

ſtle is articulated with the ſecond. They ariſe from the backe line or ſpine of the Ewer-griſtle, and doe runne vp with oblique fibres to the middle thereof, and where the two parts of the griſtle are tyed together they alſo are ioyned and inſerted. Theſe are ſmall, *Columbus* and *Archangelus* ſay they be the leaſt in the whole body: on the one ſide they bunch out like peares, but within they grow to the griſtle, in the midſt where they ioyne they are broader and thicker, as alſo where the white line appeareth, and ſeeme to grow into one in a common Tendon, then they become neruous for more ſtrength that they might not be indangered in their perpetuall motion, eſpecially when we hold our winde vpon occaſion long; and therefore ſome haue accounted them for one muſcle, ſome for two; and becauſe they are on either ſide fleſhy they are to be numbred among thoſe that haue their Tendon in the middeſt, as is the fifth muſcle of the lower iaw called therefore *Digaſtricus* or double bellied, and alſo the fourth paire of the bone *Hyois*.

The vſe of theſe muſcles is to moue the ewer-griſtle ſidelong to the right hand and to the left; yea to conſtringe or knit the baſis or foundation of the ſame, to draw both his parts together, to preſſe them one to the other, and ſo to ſtraighten and cloſe the cleft; whereby it is manifeſt that this third griſtle was neceſſarily made double, for if it had bene ſingle it could not haue beene ſtraightned by theſe muſcles nor ſhut by the fourth paire, nor opened by the ſecond and the third paires. Moreouer theſe inward muſcles being inflamed the moſt acute and ſharpe Squinaſie is ingendred: for when they ſwell, by reaſon of the aboundance of the matter the outgate of the breath is hindered, and ſo the patient inſtantly ſuffocated, which wee haue knowne in the hundreds of Eſſex to happen within twelue houres after the diſeaſe began.

Why the Ewer-griſtle muſt be double.

The moſt acute ſquinaſie

The vſe of the muſcles of the Larinx or throttle as well common as proper, is to moue the griſtles thereof with voluntary motion to the infinite modulations or diuers accents of the voyce: ſo that when part thereof, eſpecially the vpper, is fitly dilated & ſtraightned, or opened and ſhut; the cleft of it (which is the proper and immediate organ of the voyce) might be either dilated for a baſe, or ſtreightned for making an acute or ſhril ſound which verily the common muſcles doe more manifeſtly, and the proper more obſcurely. Theſe muſcles are altogether diuers from the muſcles of the bone *Hyois*, and of the tongue: for if when they be at reſt, you put your hand to your Larynx and offer to ſing in baſe tunes, you ſhall perceiue the throttle to deſcend downewatd, and in ſhrill and treble you ſhall manifeſtly perceiue it to aſcend vpwards.

The vſe of all the muſcles of the throttle.

How they differ from the muſcles of *Hyois* and the tongue.

CHAP. XX. *Of the muſcles of the Epyglottis or the ouer-tongue.*

Alen is of opinion that the motion of the *Epyglottis* or ouer-tongue is in a man not voluntary but naturall, or at leaſt hee leaueth it doubtfull whether it haue any muſcles or no. *Veſalius*, *Platerus*, *Columbus* and *Laurentius* thinke and reſolue there are none, yet *Platerus* maketh queſtion whether they be not found in ſuch men as doe eaſily vomit. Of the ſame opinion alſo is *Bauhinus*, *Aquapendens* thinketh the motion of it voluntary & performed by membranous muſcles. For my owne part I dare not ſtickle in ſo nice a queſtion. In beaſts that chew the cud they all acknowledge that it hath muſcles, thoſe we will briefly deſcribe for the helpe of young Anatomiſts who do often in the want of mens bodyes diſſect the throttles of Oxen or Sheepe to practiſe themſelues.

Diuers opinions of the *Epiglottis*.

There are therefore in beaſts 2. paire of muſcles belonging to the *Epyglottis* or ouer-tong, the firſt are called *Hyoglotti*, or the bone-tong, the ſecond the Ewer-tongue muſcles.

In beaſts two paire.

The *Hyoglotti* or bone-tongue muſcles are ſeated in the backe of the ouer-tong, they ariſe from the middeſt of the inner part of the bone *Hyois*, and are inſerted on either ſide into the Baſis of the *Epiglottis* neare his middle. They raiſe vp the ouer tongue after it is depreſſed in the ſwallowing of meate and drinke, to make free paſſage for expiration which otherwiſe would by it be intercepted.

The 1. paire.

The Ewer-tongue muſcles becauſe of the largneſſe of the Larinx or throttle are moſt euident in oxen. They ariſe fleſhy from the vpper part of the Ewer-griſtle at his articulation. At their originall they are contiguous or touch one another, and for a great ſpace ſeeme vnited and mingled, and runne a long courſe keeping their proportion through the inſide of the Shield-griſtle, & at length retaining their vnition or coniunction are inſerted into the inner Baſis of the Epyglottis or ouer-tongue-

The 2. paire

CHAP.

CHAP. XXI. *Of the Muscles which moone the head.*

THe head is mooued primarily or secondarily. Primarily aboue the second rack-bone of the Necke or aboue the first: aboue the second either bending forward or extending backward, aboue the first it is moued as a Naue vppon an Axletree, or rather as the Poyse of a Watch vpon his Bridge. Nine paire of Muscles.

All these motions are performed by seuen or rather by nine proper paire, (*Fallopius* in his *Obseruations* accounteth ten) 7 of which are *Extenders* and *Compassers* & are situated on the back part in the neck; & two *Benders* which are placed in the forepart of the necke. The head is mooued secondarily and by accident when it followeth the motion of the necke: the muscles therefore of the necke moone the head but onely vnto the sides. For if the necke be not mooued, wee cannot incline the heade at all to the Shoulders.

The 1 paire.

The first paire are called *Splenij* or the splintes, because they are very like the rowled splints which Chyrurgeons vse when bones are broken. [ta.10. Δ Δ, their original is marked with 8. their insertion is with 9] They are long and thicke, and on both sides rest vpon the rack-bones, and albeit they are very fleshy yet at their original from the fiue vpper rack-bones of the Chest (for they rarely reach vnto the sixt) they are sinewy. From thence they ascend vpward and grow fleshy receiuing a new original from the Ligaments of the rack-bones of the necke; some thinke they arise onely from hence, some from both places; howsoeuer their ascent to the head is not direct but somewhat oblique, & from that part of them which proceedeth out of the spines of the chest are produced two membranous Tendons which are inserted into the transuerse processes of the first and third *Ver-* Originall double.

TABVLA X.

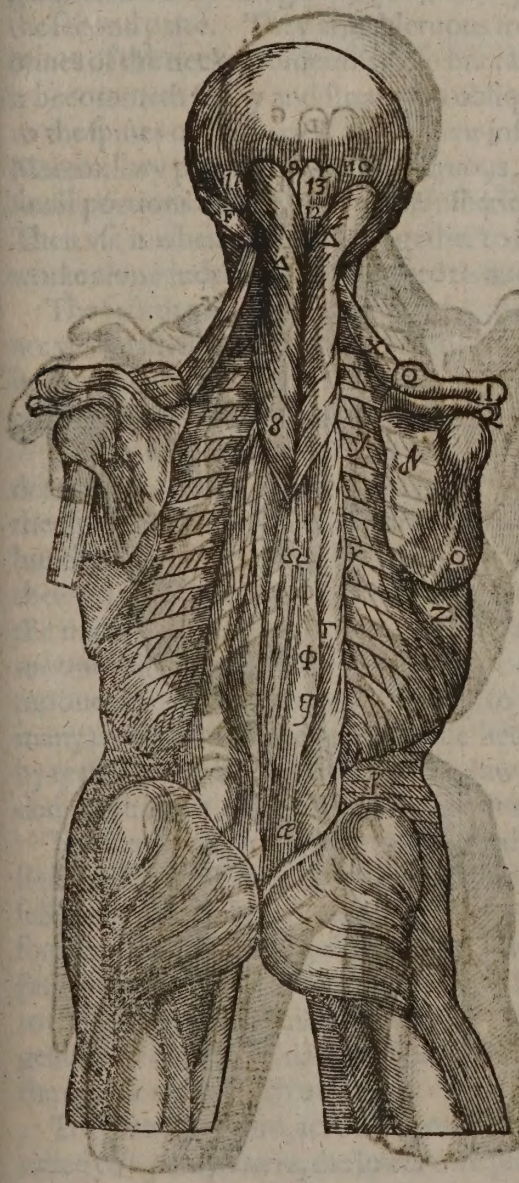


Table x. Wherein some Muscles of the heade, the chest, the arm, & the shoulder blade are described.

I, The processe of the shoulder-blade, called the top of the shoulder.

O, the fourth Muscle of the arme or *the greater round Muscle* to which *Fallopius* his right muscle is adioyned, which some cal the *lesser round muscle.*

QQ, the sixt muscle of the arme or the vper *blade-rider.*

X, the 2 muscle of the shoulderblade or the *Leuator* or *heauer.*

Z, the second muscle of the Chest or the *greater Saw* muscle.

Γ, the fift muscle of the chest or the muscle called *Sacrolumbus.*

α,β. His place wherein it cleaueth fast to the longest muscle of the backe.

γγ, the tendons of this muscle obliquely inserted into the ribs.

ΔΔ, the first paire of the muscles of the heade or of the Splinters.

Ch. 8,9. their length whose beginning at 8 & insertion at 9.

10,11, the sides of this Muscle.

12, that distance where they depart one from the other.

13, the two muscles called *Complexi*, neare their insertion.

Φ, the second muscle of the backe or the *Longest* muscle.

Π, the fourth muscle of the backe or the *Semi spinatus.*

Λ, the shoulder blade bare.

p, A part of the transuerse muscle of the *Abdomen.*

tebræ of the necke, or ſometimes of the ſecond, third and fourth, *Laurentius* will haue them to haue a double inſertion; one part of them into the tranſuerſe proceſſes of the ſecond Racke-bone, another part into the *Occipitium* of the head toward the ſides of the *Labdall* ſuture, and thither I am ſure their fleſhy part reacheth. For they are neruous in the Cheſt, and fleſhy from thence forward, their fibres running obliquely vpward from the ſpine of the lower to the tranſuerſe proceſſes of the vpper racke-bones, all of them at length determining in the Nowle: yet *Columbus* ſayeth they are right as long as the two muſcles ioyne, and become oblique but after their diuiſion. For where they ariſe at the ſpine of the Cheſt they make a ſharpe nooke or angle which is dilated as they aſcend, and about the third Racke-bone of the necke the right is ſeuered from the left with a notable diſtance [tab. 10. character 12.] ſo as the ſpace betweene them reſembleth a triangle [tab. 10. char. 9. 10. 12.]

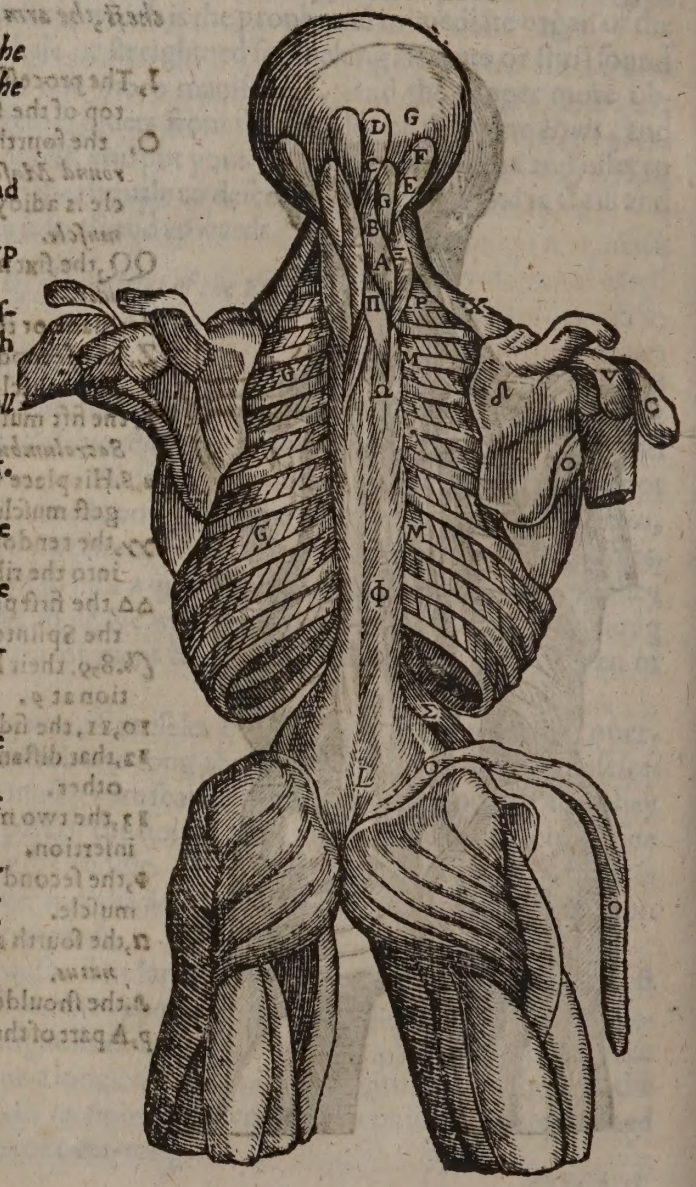
Their Implantation is broade and fleſhy into the Nowle [tab. 10. from 11. to 9.] and ſo they haue three ſides: one from their beginning to their parting aſunder; the ſecond from thence to the Nowle; the third from the nowle backe to their originall. *Falopius* hath obſerued that ſometimes they are inſerted with a neruous particle into the proceſſe called *Mammillaris* or the Teat-like proceſſe.

The vſe of this paire is when they both moone, to draw and extend the head directly backeward: but when one of them onely worketh then they turne the head to the ſides, and the right moueth ſomewhat backward ſaith *Archangelus*.

The 2. paire. The ſecond paire are called *Complexi* [ta. 11. A B C D] or the brayded Muſcles, becauſe they are wouen and brayed together with the third and fourth Muſcles of the necke like a flat poynt wouen of diuers threds, or elſe becauſe of the diuers formes. For their origi-

TABVLA. XI.

Table 11. *ſheweth ſome Muſcles of the Head, the Backe, the Cheſt, the Shoulder-blade and the Arme.*



A D, the ſecond paire of the Muſcles of the head or the two *Complexi*, the firſt part is at A D.

B C the ſecond part, E F, the third part riſing vp vnder G and inſerted at F.

G, the fourth part of this muſcle or the right muſcle of the heade according to *Falopius*, which *Veſalius* made the fourth part of the ſecond.

G G, (Betwixt the ribs) the externall *Intercoſtall* muſcles.

L, the originall of the ſecond muſcle of the back.

M, His tendons at the rack-bone of the necke.

The vpper O the fourth muſcle of the arme or the *greater round* muſcle.

O O, the lower, the ſixt muſcle of the Cheſt or the *Sacrolumbus* hanging from his originall.

Q the ſixt muſcle of the arme or the vpper *Blade-rider* inuerted.

V, the third ligament of the ioynt of the arme.

X, the fourth muſcle of the ſhoulder-blade or the *heauer*.

Z, the ſecond muſcle of the Cheſt or the greater *Saw-muſcle*.

Ξ, the third muſcle of the neck called *trãſuerſalis*.

Π, the fourth muſcle of the necke called *Spinatus*.

Σ, the firſt muſcle of the back or the *Square muſcle*

Φ, The ſecond muſcle of the backe or the *Longeſt* whoſe originall is at L and his tendons at the *vertebræ* at M M.

Ω the fourth muſcle of the backe called *Spinatus*.

ſ, the backe of the ſhoulder-blade flayed.

nals

nals are of diuers faſhions, and they are diuerſly alſo inſerted into the Nowle or *occiput*. They haue many tendinous parts, and many alſo fleſhy, ſo that each of them ſeemes to be compounded as it were of three ſeuerall Muſcles, or rather hath three Originals. The firſt ariſeth farre off with a ſharpe originall euen out of the Tranſuerſe proceſſe of the fourth and fift rack-bones of the Cheſt, this immediately after his ſpringing appeareth fleſhy [at A] and of the faſhion of a Mouſe, when it atteyneth vnto the beginning of the Necke [at B] it ceaſeth to be fleſhy and endeth as it were in a round Tendon, and hauing ouercome the roote of the necke at [C] it groweth fleſhy againe (as the Muſcle of the bone *Hyoïs* called *Digaſtricus* or double-bellied) and ſo is inſerted in the middle of the Nowle-bone. [at D]

The ſecond originall or beginning of this Muſcle is ſhorter, growing round and neruous out of the ſpine of the ſeuenth racke bone of the necke. [at C] *Platerus* addeth ſom- The ſecond. times of the firſt, and ſometimes of the ſecond, as it aſcendeth it becommeth fleſhie and is mingled with the former before his inſertion is implanted into the nowle. The third [Ta. 11 from F to F] is ſituated in the ſide and ſpringeth partly fleſhy, partly neruous from the tranſuerſe or ouerthwart proceſſes of the ſecond and firſt racke-bones of the Cheſt. The third. *Platerus* addeth from the fiue lower of the necke. From thence it proceedeth obliquely outward and becommeth fleſhy and broad and is inſerted into the Nowle at the root of the Mammillary proceſſe, but it is not of the ſame forme in Dogs and Apes. Theſe muſcles if they worke together, they extend the head directly drawing it backward, if eyther of them mooue alone the head is drawne round to one ſide. *Archangelus* addeth a little alſo backward by the right and forward by the left.

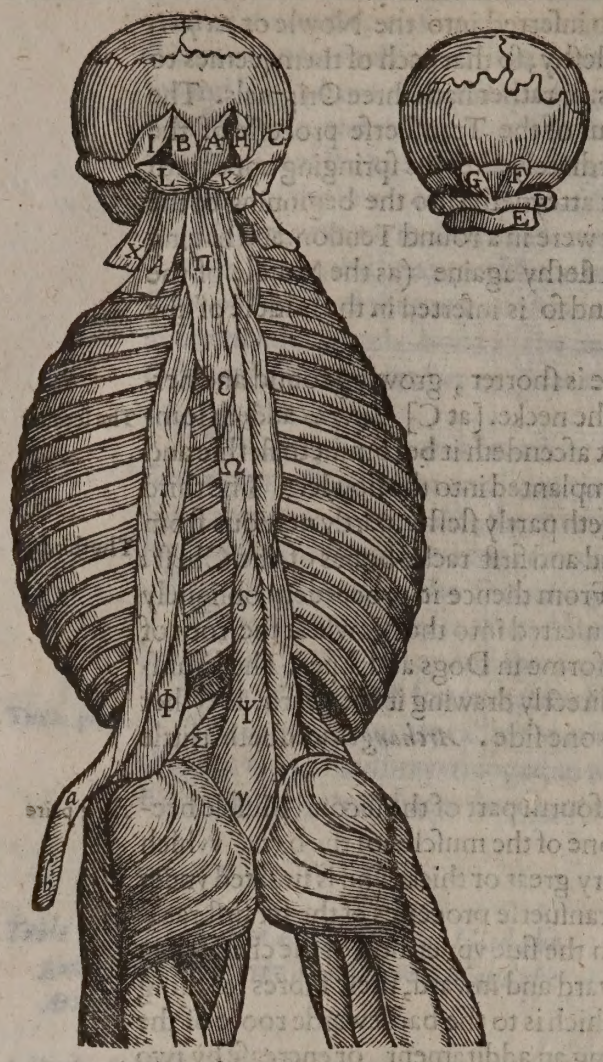
The third paire (which *Veſalius* reckoneth for the fourth part of the ſecond Muſcle bee- The 3 paire ing deceyued ſaith *Falopius* by certaine fibres of one of the muſcles of the backe which grow to the beginning of it) [Tab. 11, GG] is not very great or thicke and is ſituated vnder the ſecond paire. They ariſe Neruous from the tranſuerſe proceſſes of the ſix firſt rack-bones of the necke; ſometimes alſo but rarely from the fiue vppermoſt of the cheſt; then it becommeth fleſhy and ſtretcheth obliquely vpward and inward, their Fibres reaching to the ſpines of the bones, and at their inſertion which is to the backewarde roote of the Mammillary proceſſe they end Neruous, receyuing an additament or encreaſe by two ſmall portions ariſing from the tranſuerſe proceſſe of the firſt rack-bone of the Necke. Their vſe is when they moue together to lead the head lightly backward; if either of them worke alone it draweth it backward to one ſide.

The fourth paire which are called *Recti maiores* the greater right Muſcles [Tab. 12, A B] The 4. paire are yet ſmall, fleſhy and ſlender, ariſing from the top or height of the ſpine of the ſecond bone of the necke at [E] where they touch one another, but preſently part againe & aſcend both vpward and end round in the middle of the Nowle or *Occipitium*.

The fift paire called *Recti Minores*, the leſſer right muſcles [Tab. 12, FG] are ſituated vn- The 5 payre der the former and are like them in ſubſtance, forme and progreſſe. They ariſe cloſe together from the back part of the firſt *Vertebra* where the bone ſhould haue ended in a ſpine but that ſpine is wanting, becauſe it would haue offended thoſe muſcles: preſently after their originall they part and aſcend vpward, and on either ſide are implanted round into The vſe of the two laſt pairs. the middle of the Nowle. The two laſt paires haue one and the ſame vſe, which is if they mooue together directly to extend the head drawing it backewarde, but if one of them mooue alone, it mooueth it circularly to one ſide. Nowe the reaſon why there are ſo many muſcles appointed to draw the head backward, is becauſe the forpart of the head by reaſon of the face and the neather Iaw is very heauy and weighty, and therefore needed more helpe to retract it, whereas it noddeth forward very eaſily.

The ſixt paire, according to *Veſalius* the fift, are called *Oliqui ſuperiores* the Vpper ob- The 6 paire. lique muſcles, [Tab. 12, II] they are ſeated vnder the right, and are like them in forme & ſubſtance: ſmall they are and ariſe out of the middle of the Nowle at the vtter ſide of the fourth paire, thence they deſcend downward, and are ouerthwartly inſerted into the top [at D.] of the tranſuerſe proceſſes of the firſt rackbone of the Necke, the right muſcle into the right proceſſe, and the left into the left. Their vſe is, if they both mooue to nodde gently and directly backward, if one alone then the head enclineth backward to that ſide the muſcle is on which mooueth.

The ſeauenth paire, according to *Veſalius* the ſixt, according to *Columbus* the fifte, are The 7. paire called *Obliqui inferiores*, the lower oblique muſcles. [Tab. 12, KL] They ariſe from the ſpine



TABVLA XII. *Sheweth the Muſcles of the Head and the Necke.*

A,B. The third paire of the Muſcles of the head called *Recti Maiores.* C. the Mamillary proceſſe.

D. The tranſuerſe proceſſe of the firſt rackbone of the necke.

E. The proceſſe of the ſecond rackebone of the necke

F,G. the fourth paire of muſcles of the head called *Recti minores.*

H,I, the fift paire of muſcles of the head called *Obliqui Superiores.*

K,L. the fixt paire of muſcles of the head called *obliqui Inferiores.*

X. the fourth paire of Muſcles of the ſhoulder blade.

Λ, the ſecond muſcle of the necke cald *Scalenus* which *Falopius* maketh the right muſcle of the Cheſt.

Π, the fourth muſcle of the necke called *ſpinatus.*

Σ, the firſt muſcle of the backe called *Quadratus.*

Φ, the ſecond muſcle of the backe called *Longiſsimus.*

a, The *ſinus* or boſome of this Muſcle, whereby it giueth way vnto the third muſcle of the backe, called *Sacer.*

b. His Originall.

Ψ, the third muſcle of the backe called *Sacer.*

γ, His originall.

δ, His end.

Ω, The fourth muſcle of the backe called *Semiſpinatus.*

ε His vpper end vnder the fourth Muſcle of the necke,

of the ſecond rack-bone of the necke [from ε to b] and paſsing obliquely vpward are implanted into the tranſuerſe proceſſes of the firſt *Vertebra.* Theſe, as alſo the oblique ſuperiors, are longiſh, round and fleſhy (farre larger in Dogs and Apes then in men) and do make a triangle of equall ſides.

The vſe of this ſeuenth paire is ſemicircularly to mooue the head (for it hath not perfect circular motion) with the ſecond *Vertebra* vpon the firſt when one mooueth alone. If they both mooue, either they keepe the head ſteddy as *Fallopius* in his obſeruations conceiueth, or elſe do draw it backward a very little, euen ſo much as may rather giue reſt to the ſecond racke-bone then motion; for the motion and reſt of the head followeth the motion or reſt of that ſecond *vertebra* or rack-bone.

The 8. paire. The eight paire which is the ſeuenth according to *Veſalius* are called *Maſtoidei* [Tab. 6 fig. 2 ε the latter, ta. 7. fig. 2 ε] They are ſeated forward toward the face next vnder a membranous and broad muſcle in the necke; [Tab. 6. fig. 1 r] ſtrong they are, long and round,

Situation. and do appeare in leane carkaſſes vnder the skin before it bee diſſected, yea in liuing bodies, and theſe are they which the Ancients ſo diligently obſerued in their Coynes. They ariſe from the middeſt of the top of the breſt-bone [at ζ] and from a part of the Clauicle where it approacheth neere the breſt-bone [at σ] to be articulated with it: at which their

Originall. originall they are Neruous and broad, but more neruous where they ariſe from the breſt bone, and from thence aſcend obliquely vpward and become fleſhy and thicke, and are obliquely inſerted with a fleſhy and thicke end into the Mamillary proceſſe (which they

Inſertion compaſſe with their largeneſſe) and into the backpart of the Nowle. [Tab. 6. fig. 2 the vpper τ] And this muſcle by reaſon of his double originall betweene which there is a kinde of hollownes [between ρ & σ. f. 2] becauſe it ſeemeth as if it might be diuided into two, ſom do diuide it into many. Their vſe is if they moue together to bend the head forwarde into

Vſe. the boſome as when we nodde, either carrying the necke ſtiffe or inclining it: if one of them onely worke then the head is mooued forward to the left ſide if it be the right Muſcle, and to the right ſide if it be the left, which motion we may plainly perceiue in guiding a horſes necke with the reines. This paire with the ſecond paire of the bone *Hyoïs* [Tab. 6. fig. 2 γ γ] make a croſſe in the Necke.

The

The ninth paire [tab.13.at the ſide of A B] is added by *Falopius*, deſcribed in ſome ſort by *Galen*, and is ſituated vnder the gullet in the forepart of the necke: it is a diuerſe muſcle from the firſt paire of the necke [ta.13.A B] to which it adioyneth. It ariſeth neruous from the Ligaments of the racke-bones of the necke, which Ligaments or Chordes doe ariſe from all the tranſuerſe proceſſes of the racke-bones of the necke, eſpecally from the 7.6.5.4.and third.

After his originall this Muſcle groweth ſomewhat fleſhy, and aſcending vpward is inſerted with a fleſhy end into the Baſis of the head betwixt the two proceſſes where the head is articulated with the firſt *vertebra*. His vſe is when we nodde to bend the head ſomewhat forward. And thus much of the Muſcles of the Head.

CHAP. XXII. *Of the Muſcles of the Necke.*

THE Muſcles which moue the Necke primarily, and ſecundarily or by accident the Head, are on either ſide three, or foure if you adde the *Scaleni*, which we account rather among the muſcles of the Cheſt: theſe are ſituated vnder the Muſcles of the Head, ſome of them before at the ſides of the necke, ſome of them behinde.

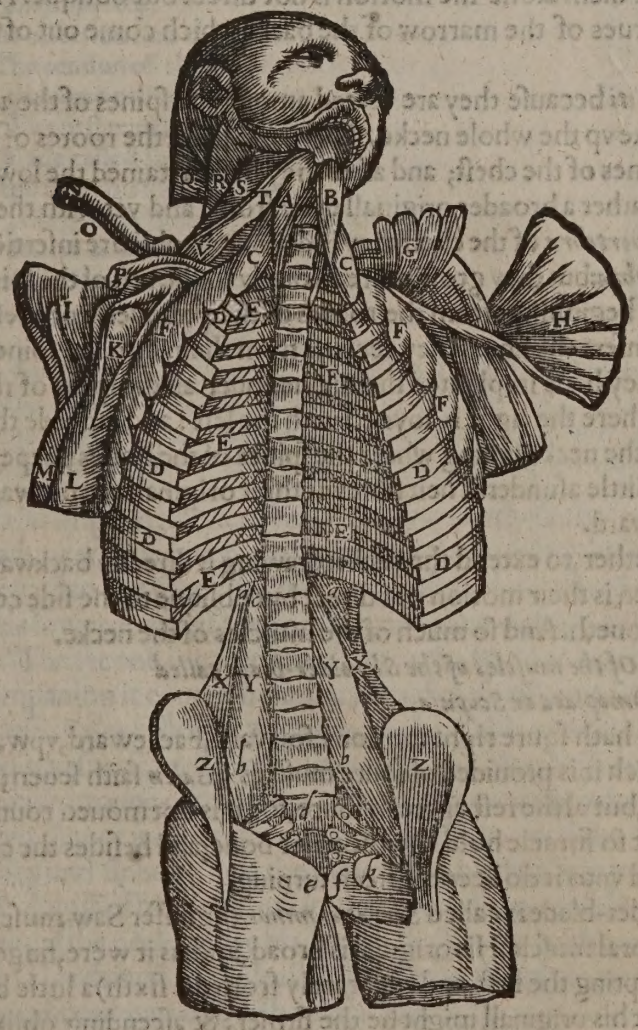
The motions of the necke.

Theſe motions of the Necke are to bend forward to extend backeward to incline to the ſides and to turne round as it were: but there are more Muſcles to draw it backward then forward, becauſe the labour is greater by reaſon of the waight of the Necke and the Head.

The firſt paire are the two Long Muſcles [ta:13.A B] which are ſeated in the forepart of the Neck vnder the Gullet, wherefore they are alſo called the *vnder Gallet-lurkers*. Theſe

Tab.13 ſheweth the cauities of the middle & the lower Bellies, all the Bowels being taken out where the Bones and Muſcles do remaine, excepting the Breaſt bone.

TABVLA. XIII.



A B, The firſt muſcle bending the necke called *Longus*.
C C, The ſecond bender of the necke call *Scalenus*.
D D D D, the outward *intercoſtall* muſcles.
E E E E, The inner *intercoſtall* muſcles,
F F F, The ſecond muſcle of the cheſt called *Serratus maior*.
G, the firſt muſcle of the ſhoulder-blade called *Serratus minor* ſeparated from his originall.
H, the firſt muſcle of the arme called *Pectoralis* ſeparated from his originall.
I, The 2. muſcle of the arme called *Deltoides*.
K, the bone of the arme without fleſh.
L, the firſt muſcle of the cubite called *Biceps*.
M, the 2. muſcle of the cubit called *Brachiæus*
N. the clauicle or coller-bone bent backward
O, the firſt muſcle of the cheſt cald *Subclauius*
P, the vpper proceſſe of the ſhoulder-blade.
Q the firſt muſcle of the head called *obliquus inferior*.
R, the 2. muſcle of the head called *Complexus*.
S, the fourth muſcle of the ſhoulder blade called *Leuator*.
T V, The two bellies of the fourth muſcle of the bone *Hyois*.
X X a a. The fift muſcle of the back whoſe originall is at *aa*.
Y Y *bb cc*, The ſixt muſcle of the thigh called *Pſoæ*, whoſe original is at *cc* & tendon at *bb*.
Z Z, the ſeauenth muſcle of the thigh.
d, The holy bone. *ooo*, The holes of the holy bone out of which the nerues do yſſue.
e, A portion of the fift muſcle of the thigh ariſing from the ſhare-bone.
f, The ſharebone bared. (*circumacter*.
k, The ninth muſcle of the thigh or the firſt

ariſe with a fleſhy thin and ſharpe beginning from the body of the fifth racke bone of the cheſt where the rib is articulated to it, and aſcending broader doe grow to the fiue vpper *vertebræ* of the cheſt and all of the necke. They alſo as they aſcend by degrees do approch or incline one to the other, yet ſo as they leaue the middle part where the gullet deſcendeth vncouered, but at their determination they ioyne in a neruous and ſharpe Tendon, and are implanted into the bunching proceſſe of the firſt racke bone: ſometimes but rarely they are implanted & that obſcurely into the nowle, euen at the great perforation thereof; ſo that it may ſeeme the nowle is turned by them. Their vſe is by their propper motion when they work together to bend the necke directly foreward and withall to incline the head, but if one of them moue alone, then is the necke inclined forward into that ſide which is contracted, or on which the muſcle moueth.

The 2. paire

The ſecond paire make thoſe which are called *Scaleni* and are accounted as the 8. muſcle of the Cheſt. [tab. 13. ᶜ ᶜ tab. 12. ʌ.] Their ſituation is on the ſides of the necke rather before then behinde. They are eſteemed to ariſe fleſhy and large from the firſt rib, and to be inſerted into all the tranſuerſe proceſſes of the racke bones of the necke, excepting ſometimes the firſt and the ſecond; from which we thinke with *Falopius* they haue their originall. Their vſe is alſo thought to be, to bend the necke foreward as doth the firſt paire: this one thing is peculier to them ſaith *Veſalius*, and *Platerus* conſenteth, that they haue a

The 3 paire. through-paſſage by which the veines and arteries do run into the arme.

The third paire (which *Veſalius* maketh the third paire of the back, but *Platerus* the third paire of the necke) are called *Tranſuerſales*, or the two ouerthwart muſcles. [Tab. 11. ≡.] Their ſeate is in the backe, and they ariſe from the rootes of the tranſuerſe proceſſes of the ſixe vppermoſt rackebones of the Cheſt, from whence by degrees they become ſtronger and thicker, and are inſerted into the outſide of the tranſuerſe proceſſes of all the bones of the necke, but more rarely into the firſt. Sometimes they haue two other originals, one from the ſecond paire of muſcles of the backe, the other from the fift paire of the cheſt, which together make vp theſe muſcles. Their vſe is, if they worke together to extend directly backeward, if one of them alone the motion is not direct but oblique. Alſo betweene theſe do paſſe thoſe nerues of the marrow of the backe which come out of the rackebones of the necke.

The 4. paire,

The fourth paire called *Spinati* becauſe they are ſeated among the ſpines of the *vertebræ* [tab. 12. π.] do occupy or take vp the whole necke. They ariſe from the rootes of the ſpines of the ſeuen vppermoſt bones of the cheſt; and after they haue attained the lowermoſt *vertebra* of the necke, they gather a broader originall therefrom, and yet with the fi-

Their quaint paſſages. bres which they receiued frō the *vertebræ* of the cheſt they indeuour an obſcure inſertiō in to the ſpine of the lowermoſt *vertebra*: but they grow more ſtrongly to the reſt of the ſpines of the necke bones, and draw new beginnings from the rootes of their tranuerſe proceſſes euen to the ſecond *vertebra*, and inſert the fibres they receiue from them into the ſpine of the rackebone next aboue, till they haue implanted themſelues ouer all the ſpine of that ſecond racke bone of the necke, where the right is ioyned with the left: and indeede they ioyne all along their progreſſe vp the necke ſauing where the ſpines of the bones peepe vp betweene them and ſeuer them a little aſunder. Their fibres at their originall are outward, but as they aſcend they incline inward.

Their vſe is if they worke together, to extend the necke, drawing it directly backward, but if one of them moue alone then is their motion not direct but oblique to the ſide contracted, or on which the muſcle moueth. And ſo much of the muſcles of the necke.

CHAP. XXIII. *Of the muſcles of the Shoulder-blade called Omoplata or Scapula.*

Why the ſhoulderblade doth not moue round

THe Shoulder-blade hath foure right motions, foreward, backeward, vpward downeward: for which it is prouided of foure muſcles, *Galen* ſaith ſeuen, & *Syluius* reckons fiue, but al the reſt agree in foure, for it is not moued round, for then it could not ſo firmele hold the ſhoulder bone; and beſides the clauicles being faſtened vnto it do keepe it from turning.

The 1. muſcle

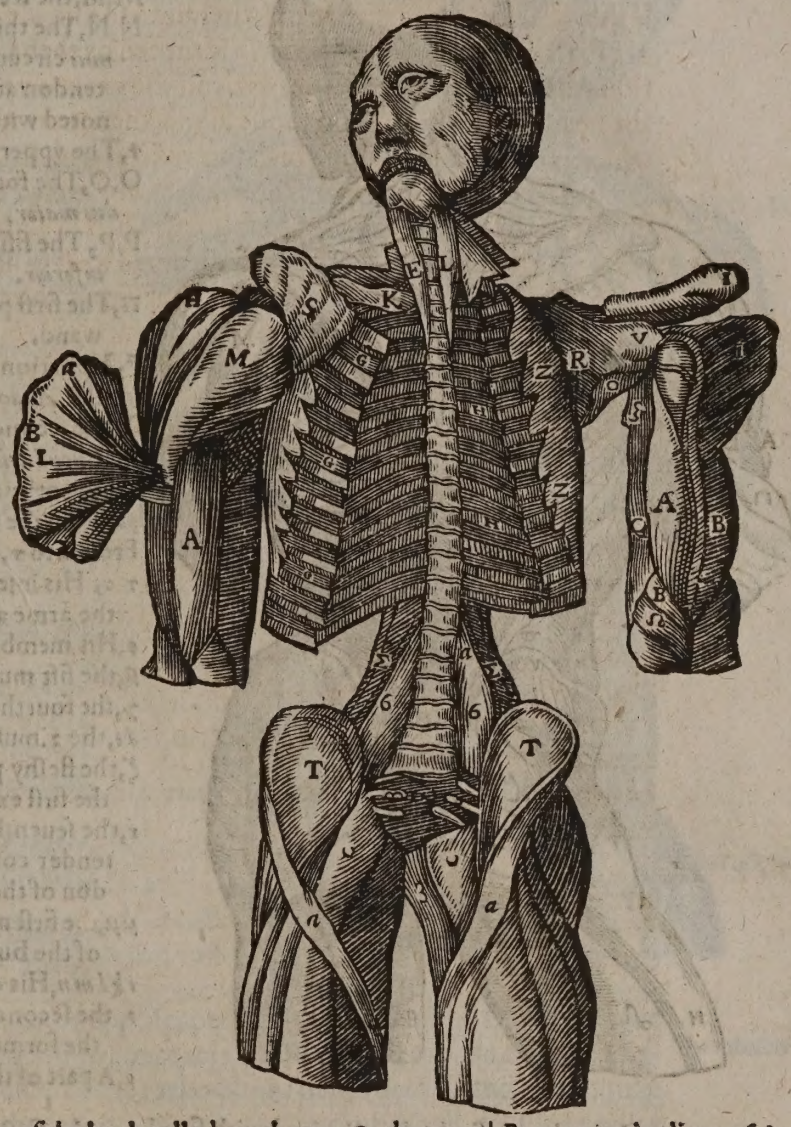
The firſt muſcle of the Shoulder-blade is called *Serratus minor* the leſſer Saw-muſcle, [tab. 14. S.] it lieth vnder the pectoral muſcle. His original is broad, and as it were, finger-fanged from the 4 vpper ribs (excepting the firſt, and very rarely from the ſixth) a little before they end into their griſtles, that his originall might be the firmer: & aſcending oblikely vpward, it groweth fleſhy and neare the ioynt narrow, and hauing faſhioned the figure

of

AA, the first muscle of the cubit called *Biceps*.
B, the second muscle of the cubit in the left arme called *Brachiaus*.
DE, the first paire of muscles of the necke vnder the gullet.
F, the 2. of the neck arising from the first rib.
GGG, the outward *intercostall* muscles.
HHH, Letters set vppon the ribbes which should haue been placed vpon the inner *intercostall* muscles.
I, the left clauicle or coller bone remoued from his place and bared.
K, the right clauicle or coller-bone in his owne place.
L, the first muscle of the arme called *Pectoralis*, remoued from his originall.
αβγ, The circumscription of this muscle.
δε, His tendon and insertion.
M, The second muscle of the arme called *Deltois*.
ζH, his originall and insertion.
N, the same muscle separated and reclined from his originall.
O, The fourth muscle of the Arme called *Rotundus maior*.
Q the 3. muscle of the cubite or the first extender.
R, The seauenth of the arme called *Subscapularis*.
ν, his insertion into the arme.
ξ, The tendon of the third muscle of the arme called *Latissimus*.
S, The first muscle of the shoulder-blade called *Serratus minor*, eleuated from his implantation.
TT, the 7. muscle of the thigh called *Iliacus internus*.
Y, the first muscle of the chest called *subclauius*.
ZZ, the 2. muscle of the Chest called *Serratus maior*. ΣΣ, the first muscle of the back called *quadratus*. Ω, the round *Pronator* or incliner of the *Radius* or wand. αα, the first bender of the Leg. ββ, the 2. bender of the Leg. σσ, the first paire of benders of the thigh called *Lumbales*, whose head is marked with *a* and his tendon with *b*, νν, the third paire of benders of the thigh. φφ, Paires of nerues which goe vnto the thigh, ω, the Holy-bone.

Table 14. *sheweth the body, such as it appeareth after the Bowelles of the Lower and Middle Bellies are taken away. The right Arme with his Muscles remayneth in his naturall situation, except the Pectorall and the lesser Saw-muscles, which were necessarily to bee separated and taken away with the Breast-bone. The left Arme is remoued from the side, that the blade of the shoulder and the Clauicle, and those things which lye vnder them might better appeare.*

TABVLA. XIIII.



of a Triangle is inserted with a Tendon partly fleshy partly neruous, into the shoulder-blade neare the inner processe called κορακοειδης. His vse is to bend the shoulder-blade forward to the Chest; for if his vpper fibres be contracted it moueth it to the brest higher, if his lower, lower; if his middle fibres, then directly or in a straight line.

The second is called *Cucullaris* or the Monkes-hood [tab. 15. T] because with his other companion it couereth the backe as that doeth, or as a countrey wiues broade white kerchiefe, *Galen* calleth it *Trapezius* or the Table-muscle. His originall is fleshy and thinne, and transuerse or rather oblique from the Nowle; [from ο to π] but membranous & broad from the toppe of the spines of the necke euen vnto the height of the Chest: [from σ to ϱ] from thence it is straightned as it passeth toward the shoulder-blade, and is implanted fleshy and sinnewy into the spine of the blade, the top of the shoulder-bone and the middle almost of his Basis, and into the broader part of the *Clauicle*. [τ υ] VVhere it looketh toward the necke of the blade, you shall meete with a membranous and neruous semicircle [φ] ordained haply least it should too straightly presse the muscle which sitteth vppon the gibbous part of the shoulder-blade [ᴹ]. The 2. muscle.

TABVLA XV.

Sheweth the muſcles on the backeſide of the body.

A, A part of the 1. muſcle of the cubit cald *biceps.*
B, The vpper and vtter part of the ſecond muſcle of the cubite called *Brachiæus.*
C, The third muſcle of the cubite.
D, The fourth muſcle of the cubite.
K, The inſertion of the ſeuenth muſcle of the head called *Maſtoides* into the mammillary proceſſe.
M, M, the ſecond muſcle of the arme called *Deltois*
N, N, The third muſcle of the arme called *Latiſſimus* circumſcribed with κ λ μ, a part of whoſe tendon at the inſertion in the former table is noted with ξ.
π, The vpper part of the Cowle muſcle.
O, O, The fourth muſcle of the arme called *Rotundus maior.*
P, P, The fifth of the arme called *ſuper-ſcapularis inferior.*
Π, The firſt part of the *ſupinator* of the *Radius* or wand.
*, A portion of the oblique deſcendent muſcle of the *Abdomen.*
T, the ſecond muſcle of the ſhoulder blade called *Cucullaris.*
ϑ π. the originall of this muſcle from the nowle.
ϱ σ, From the ſpines of eight rackbones of the cheſt
From σ to π, from the ſpines of the necke.
τ υ, His inſertion into the ſpine of the blade into the arme and clauicle.
φ, His membranous ſemicircle.
β, the fift muſcle of the leg called *Semimembraneus*
γ, the fourth muſcle of the leg called *biceps.*
δ ε, the 3. muſcle of the leg called *Semineruoſus.*
ζ, the fleſhy part of the firſt muſcle of the leg or of the firſt extender.
η, the ſeuenth muſcle of the leg, or the ſecond extender couered ouer with the membranous tẽdon of the ſixt.
μ μ, the firſt muſcle of the thigh, or the firſt authour of the buttockes.
i k l m n, His originall at i k l, his inſertion at m n.
ρ, the ſecond muſcle of the thigh hiddẽ almoſt by the former.
ρ, A part of the 5 muſcle of the thigh called. *triceps*

The 5 lines of this muſcle

It is circumſcribed or limited with fiue lines; the firſt is ouerthwart at the nowle, [from ϑ to π,] the ſecond runneth ſtraight along the ſpines, [from σ to ρ,] two are oblique, one of them from the eare to the canell bone, the other from the ende of the ſtraight line which I ſayd did runne along the ſpines. [tab. 15. from τ to ρ.] The fifth and laſt is tranuerſe in the middle of the muſcle wher it is inſerted into the ſpine of the blade, the top of the ſhoulder and the broade part of the cannell bone or clauicle. Wherefore this ſecond muſcle as well by reaſon of his diuers originall as alſo his ſeuerall kindes of fibres, mooueth the ſhoulder-blade diuerſly. For when the fibres which run along obliquely downeward from the nowle and the ſpine of the neck are retracted, that is, when the vpper part of the muſcle is retracted [at τ.] then is the ſhoulder blade lift obliquely vpward, but when the fibres which proceede from the ſpines of the cheſt obliquely vpward are gathered into themſelues, that is when the lower part is crumpled together [tab. 15. Δ.] then the blade is drawne downeward, but if the middle or the tranſuerſe fibres be contracted [at σ.] then the blade is directly led to the backe.

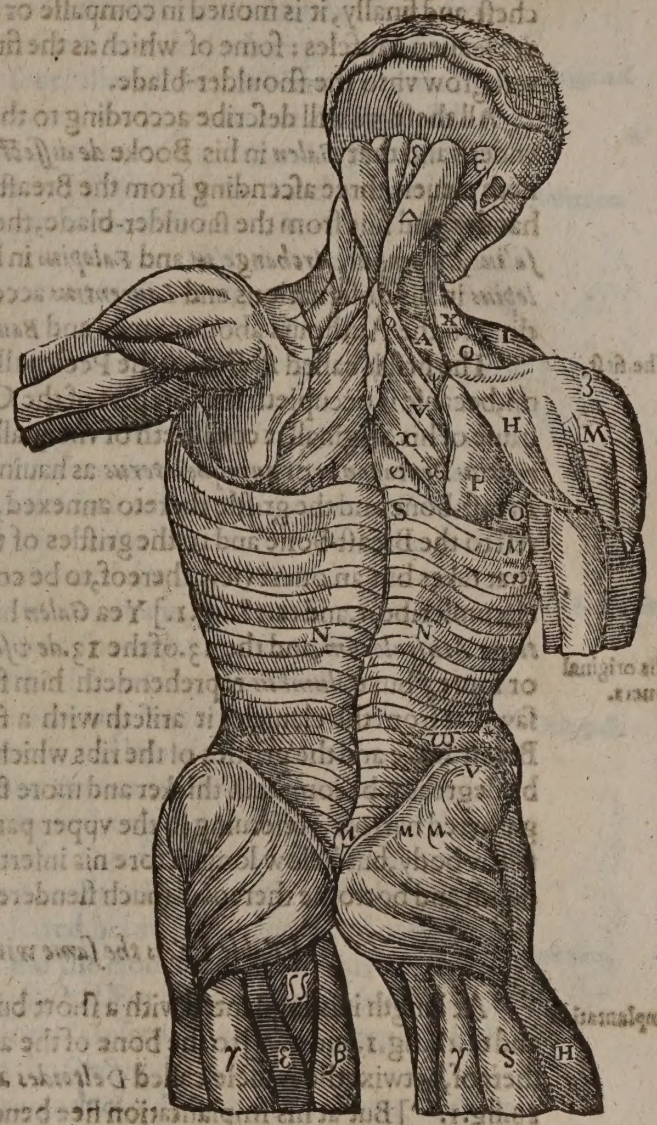
The third muſcle.

The third muſcle is called *Rhomboides*, that is, the ſquare muſcle, [tab. 16. ν.] It is ſituated vnder the former, thin, it is broad, & four-cornered, and groweth fleſhy from the ſpine of the three lower rackebones of the necke and the three vpper of the cheſt, and his fibres run oblique from the backe to the bottome or foundation of the blade, into which baſis of the blade is alſo being broade, fleſhily inſerted after the length of it, and draweth it vpward ſomewhat and backeward, and coucheth it to the backe.

The

TABVLA XVI. *Sheweth some Muscles of the Head and the Chest, the Cowle-Muscle being taken away, as also of the Blade and of the Arme.*

A. The prominent part of the fourth muscle of the Chest, called *serratus posticus superior.*
Δ the first muscle of the head called *splenius.*
E, E. The insertion of the second muscle of the head called *Complexus.*
I. The coller bone bared.
M, The backpart of the second muscle of the arme called *Deltois.*
ζ. H. His backward originall.
θ. His implantation into the arme.
NN. the 4 muscle of the arm cald *Laetissimus*
S, μ. His originall from the spines of the rack bones, and from the holy bone.
π, The connexion of this muscle with the hanchbone which is led in the inside from μ to π.
ω, the place where it lieth vpon the lower angle of the Basis of the shoulderblade.
O, the 4. muscle of the arme called *Rotundus maior.* &, Some muscles of the backe do here offer themselues.
P, the fift muscle of the arme called *super scapularis Inferior.*
Q. The 6. muscle of the arme called *Super Scapularis Superior.*
S, The beginning of the third muscle of the arme called *Latissimus.*
V, the third muscle of the Blade cald *Rhomboides.* (bones.
φ, X, His originall from the spines of the rack
ϕ, ω. His insertion into the Basis of the shoulder blade.
X, The 4. muscle of the Blade called *Leuator.*
* A part of the oblique descendent muscle of the *Abdomen.*
The other Letters in the thigh haue the same reference which they had in the former Table.



The fourth Muscle is called *Leuator* or the Heauer [Tab. 16 at x] and is situated aboue the clauicle. His originall is very diuerse (whence it is that some haue made diuerse Muscles of it) from the transuerse processes of the racke-bones of the necke, and commonlie from the 1, 3, 4, 5. but rarely from the second. But these diuers originals do soone grow into one, and passing downe do make a strong and fleshy muscle, which is inserted with a broad and fleshy tendon (his Fibres being all of them almost right, few oblique) to the vpper and inner angle of the shoulder-blade. His vse is to draw the blade vpward toward the fore-part and to the sides of the necke. The 4 muscle.

These are the Muscles by which the blade is moued originally the arme by accident, as also the blade is mooued by accident by the Muscles of the arme, for when they draw the they draw the blade also by consecution which is annexed thereto.

CHAP. XXIIII. *Of the Muscles of the arme.*

THE Ancients called all that the Hand which is betwixt the toppe of the Shoulder and the Fingers. The first part therefore of the whole Hand is called in Latine *Humerus*, which we translate the Arme, and it reacheth from the top of the shoulder to the next ioynt or bending of the Cubit, which we call the Elbow. The *Graecians* call this part βραχίων, and the cauity which is vnder the ioynt at the shoulder is called *Ala* the *Arme-pit.* The toppe iust against the pitte is properly called the *Shoulder.* This member that it may more easily be moued euery way is articulated with the shoulder blade by *Enarthrosis* (which kind of articulation wee shall make plaine in the Booke of Bones) and mooued by Muscles. The particular partes of the arme.

The

The voluntary motions of the Arme are fiue: forward to the Breaſt, backeward toward the backe, vpward toward the necke and the head, downeward to the ſides of the cheſt, and finally, it is moued in compaſſe or circumuerted. For all theſe motions there are ſeauen Muſcles: ſome of which as the firſt and the third are faſtned to the Cheſt, the reſt grow vnto the ſhoulder-blade.

All theſe we will deſcribe according to the order of diſſection: yet firſt we giue you to vnderſtand that *Galen* in his Booke *de diſſectione Muſculorum* and the 18. Chapter, reckoneth eleuen, three aſcending from the Breaſt vnto the Arme, two from the regions of the handes, and fiue from the ſhoulder-blade, the eleauenth ſeaſeth vppon the *Epomis*. *Veſalius*, *Columbus*, *Archangelus* and *Falopius* in his inſtitutions reckon ſeauen: the ſame *Falopius* in his obſeruations and *Laurentius* account eight. But wee hold vs to ſeauen according to the Authours aboue named and *Bauhine* with them.

The firſt. The firſt is called *Pectoralis* the Pectorall Muſcle [ta. 17. 1] ſo named from his ſituation, becauſe it occupieth the forepart of the Cheſt. It is a large muſcle and fleſhy, and becauſe of his originall it conſiſteth of vnequall ſides: whence it was that it is called by *Laurentius Pentagonus* or *quinquelaterus* as hauing fiue ſides. It groweth almoſt to the whole Breaſt-bone and the griſtle thereto annexed, to the middle of the clauicle where it is neareſt to the Breaſt-bone and to the griſtles of the 6. 7. and 8. ribs: ſo as it may ſeeme to him that takes but an ouert view thereof, to be compounded of many muſcles. [ta. 17. αβγ doe circumſcribe it, and ta. 18. fig. 1.] Yea *Galen* himſelfe in the 18. chap. of his Booke *de diſſectione Muſculorum*, and the 13. of the 13. *de vſu partium*, thinketh it may be deuided into 3. or foure, but *Columbus* reprehendeth him for it. Notwithſtanding for *Galen* wee may ſay; that from the clauicles it ariſeth with a fleſhy originall, and from the middle of the Breaſt bone and the griſtles of the ribs which are membranous and neruous. Afterward by degrees it becommeth thicker and more fleſhy, and is againe by degrees ſtraightned & gathered narrow, reſeruing in the vpper part by reaſon of the ſhort courſe of his fibres a fleſhy body, but below long before his inſertion it appeareth liuid and neruous, and the depth and bottome thereof is much ſlenderer then the vpper part.

His original diuers.

[*Table 17. is the ſame with Table 14. Folio 773.*]

Implantation. At length it is implanted with a ſhort but broad ſinnewy and ſtrong tendon [tab. 17. and ta. 18. fig. 1. and 2. δε] to the bone of the arme lengthwiſe a little below the inner head thereof, betwixt the muſcle called *Deltoides* and that which is called *Biceps*. [ta. 17. and ta. 18. fig. 1. ΜΑ] But at his implantation hee bendeth forwards as if his tendon were reduplicated. And truely in ſome men a portion of it is found to grow into a kind of point, immitating a peculiar muſcle, whereas indeed it is a part of this muſcle wee now entreat of. Albeit *Columbus* thinketh that *Galen* in the 18. chapter of his Booke *de diſſect. muſc.* deſcribeth this production for a particular muſcle.

His vſe. This *Pectoroll* muſcle by reaſon of his diuers originall hath alſo diuers fibres: ſome runne obliquely downward from aboue, others obliquely vpward from below: inſomuch that a little before the muſcle produceth his tendon theſe fibres ſeeme to interſect one another in a decuſſation, and yet all of them concur together into one angle to forme the tendon. This variety of fibres maketh the different motions which this muſcle performeth.

This office of this muſcle is when it contracteth equally all his fibres, eſpecially the middlemoſt in euery part of his body, to moue the arme equally and directly forward, inclining on neither hand, and to leade it to the breaſt. But if all the fibres be not equally contracted, then is it ledde indeed to the Breaſt but obliquely, more vpward or more downeward as the different fibres are contracted.

The ſecond his name. The ſecond Muſcle of the arme is called *Deltoides*, from the forme of the Letter Δ: [ta. 17. ta. 18. fig. 1. 2. 4. Μ] ſome call it *Epomis*, becauſe it lyeth vnder the leſſer head of the arme which is properly called *Epomis* by *Hippocrates*, *Galen*, *Ruffus* and *Oribaſius*, as *Falopius* in his obſeruations hath very well obſerued, thereby clearing no ſmall Controuerſie in our *Art* about the acception of the word *Epomis* in *Hippocrates* and the Ancients. Some call it *Humeralis* or the Arme-muſcle by a kinde of excelencie.

What *Epomis* is.

It is fleſhy and triangular, or *tetragonall* ſayeth *Archangelus*, ariſing from the middeſt of the clauicle where it regardeth the ſhoulder-blade, from the top of the arme where it is ioyned to the clauicle, and from the whole ſpine of the ſhoulder-blade [ta. 16. & ta. 18.

fig.

fig. 1, ξ n] But you muſt not conceyue that it taketh his Originall from the ground or ſoale of theſe bones, but from a certaine prominence or thicke line bearing out from them.

Note moreouer, that in the originall this Muſcle is broade (as being compounded of diuers yet continued beginnings like ſo many ſeuerall muſcles) & Neruous: (tendinous ſayth *Columbus*) but preſently becommeth fleſhy and thicke, and ſo remaineth till by degrees it be anguſtated or ſtraightned into the toppe or corner of the triangle, and ſo at length endeth into a ſtrong Tendon which is partly fleſhy, to wit, on the outſide, and partly Neruous, to wit, on the inſide, appearing in our diſſections to lye not perfectlie ouerthwart yet more then oblique. It embraceth or compaſſeth the middle thickeneſſe of the arme, and is inſerted in the middeſt thereof vnder the necke of it. [Table 18. fig. 2, θ] Originall. Infertion.

This Muſcle alſo hath Fibres ſomewhat diuers, thoſe of the fore part run obliquelie downward and backward, thoſe of the backe part runne obliquely forward. And ſome of theſe do appeare to be a little implicated or entangled one within another: but the middle Fibres tend directly downward. Wherefore when the *anterior* Fibres are contracted the arme is lifted vpward and forward towards the face, when the backeward Fibres are contracted, then is the arme lifted backeward toward the Nowle, but when the middle Fibres are equally contracted then is the arme eleuated directly vpward. Vſe.

The third muſcle of the arme is called *Latiſsimus*, that is, the broad muſcle, and *Aniſcalptor* the *Pruritan* muſcle, [Tab. 15 & 16 ν. Ta. 25 ſheweth it ſeparated] becauſe it reacheth neere to the buttockes, for together with his fellowe it couereth almoſt the vvhole backe, and therefore may well bee called (ſaith *Bauhine*) *Dorſalis Maximus*, the Greateſt Muſcle of the backe. It ariſeth with a membranous and broad beginning from the tops of the ſpines of the Rack-bones which are betwixt the ſixt *vertebra* of the Cheſt, and the middle of the Holy-bone, [Tab. 16 S, μ] as alſo from the vpper part of the haunch-bone: thence aſcending, when it attaineth to that part of the back where the ribs ſwell out backward it becommeth more fleſhy, and climbing ouer the lower angle of the baſis of the ſhoulder-blade it groweth narrower, and is inſerted belowe the vpper head of the arme lengthwiſe on the inſide betwixt the Pectorall and the Round Muſcles; his tendon being ſtrong and ſhort, yet broad and as it were reflected. For betwixt the tendons of thoſe two forenamed muſcles there is a diſtance left for this inſertion, in which place alſo is the cauity of the arme-pit made by this Muſcle and the Pectorall. The 3. muſcle Originall. Infertion.

The figure of it is Triangular, for it hath three vnequall Angles, two long and one ſhort. The ſharpeſt is that which groweth from the *Holy-bone*: the nexte is at the Cheſt where the Muſcle yſſueth from the Ridge of the Rackes. The third is at the arme and endeth into the tendon. Moreouer, this Muſcle when it attaineth to the lower angle of the ſhoulder-blade, receyueth ſometimes therefrom many fleſhy Fibres, as *Galen* well obſerued in his Anatomicall Adminiſtrations and in the 12 chap. of his 13 Booke *de vſu part.* which Fibres do repreſent a newe but ſmall Originall. *Veſalius* denies this and holdeth it not to touch the ſhoulder-blade, but by the interuening of Muſcles which ariſe therefrom, and that it groweth not at all to the bone; but as he reproueth *Galen*, ſo *Falopius* in his Inſtitutions reproueth him, affirming that in all the bodies that euer hee made diſſection of he found this Muſcle faſtened to the blade. *Galen* redeemed from *Veſalius.*

Bauhine rendreth a reaſon. It groweth (ſaith he) with certain Fibres to the baſis of the ſhoulder-blade, leaſt when the blade is mooued it ſhould ride ouer the muſcle, for theſe Fibres as it were Ligaments do hold the Muſcle and the blade together. *Galen* alſo in the fift chap. of his 13 booke *de vſu part.* ſaith, that by the benefit of this adheſion or cleauing the blade alſo is mooued downward by this thirde muſcle. Notwithſtanding, *Falopius* dares not for certaine affirme that it doth mooue the blade, but that it conferreth ſomething to his motion he is very confident againſt *Veſalius*.

The Fibres alſo of this Muſcle do differ according to the inequality of the ribbes; for ſome are long and leſſe oblique, others are ſhort and more tranſuerſe. Wherefore, as theſe fibres are contracted into themſelues, the arme is more or leſſe retracted downeward and depreſſed toward the backe, ſometimes higher, ſometimes lower.

The fourth Muſcle is called *Rotundus maior*, almoſt by common conſent of all Anatomiſts, *The greater round Muſcle*. [Tab. 10, 11, 14, 15, 16, 25 and Tab. 12. fig. 4 O] *Platerus* alſo calleth it the *Longer tranſuerſe Muſcle* becauſe it is ſeated obliquely on the backe ſide vnder the arme-hole. It is fleſhy, thicke and rounder then all the reſt. His Originall The 4 muſcle His name.

is

Tab. 18. *Sheweth in foure figures the muſcles of the arme, the cubit the wriſt, the wand and the fingers of the hand.*

TABVLA XVIII.

A, 1,2,3. The firſt muſcle of the cubit called *Biceps*.

B B, 2. 3,4. The ſecond muſcle of the cubite called *Brachiæus*.

C. 2,3,4. The third muſcle of the cubit called *Longus* or a part therof

D. 4, The fourth muſcle of the cubit or the ſhort muſcle.

E, 1,2. The muſcle in the palme of the hand.

F, 3. The firſt muſcle of thoſe which bend the foure fingers.

G, 3, A portiõ of the ſecond of thoſe which bend the foure fingers.

H, 3, The firſt of thoſe which bend the thumbe.

I, 3, The clauicle or coller-bone remoued from his ſeate and bored

K, 1, The coller bone in his owne place.

L. 1, The pectorall muſcle or the firſt of the Arme.

α β γ. His circumſcription and originall.

δ ε, 1. and 2. His inſertion.

μ, 1, 2, & 4, The muſcle called *Deltois* or the ſecond muſcle of the arme.

ζ υ, His broade originall.

θ, His inſertion.

ν ζ, The muſcle called *Deltois* ſeparated and the inner part of it.

O, 4, The greater round muſcle, or the fourth muſcle of the arme.

P, 4, The lower *Superſcapularis*, or blade rider; or the fourth muſcle of the arme.

p, 4, the lower. The firſt of thoſe muſcles which extend the 4. fingers.

Q, 4. The ſecond muſcle of the extenders of the foure fingers.

S, 1, 3, The fourth of the extenders of the foure fingers.

V, 4, The ſecond muſcle of thoſe which extend the thumbe. Y, 3, The ſubclauian muſcle or the firſt muſcle of cheſt. Z, 2, 4, The fourth muſcle of the extenders of the thumbe. a, b, 3. The higher proceſſe of the ſhoulder at a, the lower at b. c, 3, The brode ligament of the ioynt of the ſholder blade with the arme. d, 3, The lower round ligament. e, The vpper round ligament. f, 3, The coniunction of theſe two ligaments. g, 3, The bone of the arme fleade. h, i, 1, 2, Portions of the muſcles of the fingers from the vtter ſeat of the cubite propogated vnto the Tendons of the hands. l, 2, Tendons in the hand reached vnto the outward ſeat of the forefinger of the Char. 1, 2, 3, 4, 5, 6. in the 2. and 4. figure: the tranuerſe ligament of the wriſt diuided into ſo many ſmall circles. n. The originall of the firſt muſcle bending the fingers vnder the muſcle noted with Ω. o, 3, Fleſhy portions of this muſcle perforating the foure Tendons at r, r, r, r, p, q, The tranſuerſe ligament of the wriſt diuided and led on both ſides. r, r, r, r, 3, Foure tendons carryed vnto the fingers. ſ, 3, The vpper munks hood or cowle muſcle, t, His lower ſeate. u, y, The coniunction of the third & fifth muſcle of the cubit which *Veſalius* doth diuide. x, 4, His inſertion and a portion of the Ell fleade Δ, 1, 3, 4, The firſt muſcle bending the wriſt. Θ, 1, The ſecond bending the wriſt. Λ, 4, The firſt muſcle extending the wriſt. Ξ, 2, 4, The 2, extending the wriſt. Π. 2, 3, 4, The firſt ſupinator of the wand which turnes the hand vpward. Ω, 1. 2, 3, The other pronator of the wand which turns the hand downeward a. 3. The inſertion of the ſuperſcapularis, or blade rider.

is but ſmall yet continuall and fleſhy which it taketh from the lower ribbe or ridge of the blade at that part which is neare to the baſis, thence paſſing along when it cometh to the middle of that ridge or rib it departeth from the Blade-bone, and ariſing a litle vpward is inſerted into the vpper and inner part of the Arme with a ſhort but broad, ſtrong, membranous & neruous Tendon, where alſo it finds the 1. muſcle couched & their Tendons a like. The vſe of this Muſcle (ſayeth *Bauhine*) is to retract the arme downeward, and ſo it is

contrary

contrary to the ſecond muſcle called *Deltoides*. *Galen* reckons it among the *Turners* of the arme, for (ſayth he) it turneth the arme outward: *Veſalius* reprehends him and ſayeth that it applyeth the arme directly to the backe. But *Archangelus* beſide that direct motion, aſcribeth vnto it an outward motion and a little inward. *Laurentius* would haue his motion to be onely oblique.

At the lower part of this Muſcle or at the lower rib or ridge of the blade we finde a diſtinct portion implanted with a neruous termination neare the inſertion of the 5. muſcle which *Falopius* maketh the eight muſcle of the arme, which (ſayth hee) is manifeſtly ſeparated from all the reſt, as I haue found in all my Diſſections, and I wonder much (ſayeth he) that our late Anatomiſts haue ouer-skipt this muſcle, which is of great moment as being together with the ſeauenth the authour of the ſame motion, eſpecially becauſe *Galen* obſerued it in Apes in the 18. chapter of his Booke *de diſſect. muſcul.* and in the firſt chapter of the 5. Booke of his Anatomicall Adminiſtrations. The eight muſcle after *Falopius*.

The fift Muſcle of the Arme is called *Superſcapularis inferior*, the lower Blade-rider, [tab. 15. 16. 25.P tab. 18. fig. 4.P.] It couereth all the outward and gibbous part of the blade which is vnder his ſpine and beareth the forme thereof. It ariſeth fleſhy from the Baſis of the blade below the ſpine, becomming narrow as the blade-bone groweth narrow, & is inſerted obſcurely ſemicircular wiſe to the outſide of the Ligament of the arme which holdeth the ioynt. The 5. muſcle

The vſe of it is (ſayth *Bauhine*) to leade the arme in compaſſe outward, *Archangelus* addeth vpward alſo, *Laurentius* ſaith it retracteth it backward.

The ſixt Muſcle called *Superſcapularis ſuperior* or the vpper Blade-rider, is alſo called *Rotundus minor* the Leſſer round Muſcle. [table. 10. 11. 15. 16. 25.R] It is ſeated aboue the the Arme-hole and filleth all the cauity which is betwixt the vpper ribbe or ridge of the blade and the ſpine of the ſame; from which it ariſeth fleſhy, long and hauing long fibres, for it proceedeth from that Baſis of the blade-bone to which it groweth very ſtrongly, and when it attayneth to the vpper part of the neck of the Blade, it runneth vnder a tranſuerſe Ligament which coupleth the arme to the inner proceſſe of the blade, and with a broade and ſtrong Tendon riding ouer the ioynt is obliquely inſerted to the Ligament thereof. The fixt muſcle.

The vſe of this Muſcle ſaith *Bauhine* is the ſame with that which went before and which followeth after, *Archangelus* ſayth it leadeth the Arme vpward and backward, *Laurentius* backward onely, *Veſſalius* doeth not thinke that *Galen* makes any mention of this Muſcle, vnleſſe haply it bee reckoned among the Heauers of the Arme, for none of his deſcriptions agree thereto, although he make light mention of a muſcle riding ouer the vpper rib of the blade.

The ſeauenth muſcle called *Subſcapularis* the Blade-lurker, or *Immerſus* the drowned Muſcle, [tab. 7.R] is ſeated betwixt the Blade-bone and the ribs. Very fleſhy it is and continual with the former on the vpper ſide, occupying the inner hollow part of the Blade-bone, from whence it ariſeth. It is like the Blade triangular, ſtraightned by degrees at the inſide of the ioynt, and with a broad Tendon is Semicircularly inſerted into the inſide of the arme, (*Laurentius* ſayth into the necke and head of the arme) ſo that the Tendons of the 3. muſcles which leade the arme about do orbicularly incompaſſe the whole ligament of the ioynt. The 7. muſcle.

His vſe is to leade about the Arme inward, *Galen* in the 18. chapter of his Booke *de diſſect. muſcul.* ſayeth that it circumuerteth the head of the arme backeward: *Archangelus* that it moueth the arme vpward and inward, *Laurentius* that this together with the leſſer round muſcle and that which is called *Infra-ſpinatus* doe moue the arme ſemicircularly backward, for (ſayth he) a perfect circular motion the arme hath not from any peculiar muſcle, but by the ſucceſsiue working of them all, for that which is circular is compoũded of all the right and all the oblique.

That notable muſculous portion ariſing from the proceſſe of the Blade-bone which is like an Anchor, and inſerted into the arme; *Arantius* and *Placentinus* doe eſteeme to bee a muſcle of the arme; others account it for the firſt muſcle of the cubit. His vſe ſay they is to leade the arme to the proceſſe of the Blade-bone, and indeede the motions of the arme and cubit are neare of kinne, for when the cubit is bent in the Elbow, it is moſt what neceſſary that the arme alſo ſhould be lifted vp, as we may obſerue in our ſelues, and ſo much of the muſcles of the Arme. The muſculous portion.

CHAP.

CHAP. XXV. *Of the Muſcles of the Cubit.*

The bones of the Cubite.

THe Cubit which is the ſecond part of the Hande in the large acceptation, conſiſteth of two bones, the firſt is called *Cubitus* or *Vlna*, the Cubite or the Ell, and we retaine that name when we call the place where it is bent the *Elbow*. The ſecond bone is called *Radius* or the *Wand*. Theſe bones haue diuers motions, and therefore the Muſcles of the Ell and the Wand are diuers. The Cubit or Ell hath two motions, for it is bent and extended directly. *Galen* attributeth alſo to it an oblique motion, which *Columbus* ſaith is neuer to bee founde in a man: the *Radius* or wand being mooued turnes the hand vpward and downward. Firſt we will ſpeake of the motions of the Cubite which are performed by the helpe of foure Muſcles, ſome ſay fiue, and theſe are called the muſcles of the Cubite, not becauſe they are ſeated in the Cubit, but becauſe they mooue it. For they ariſe from the arme and the blade, and take vp the roome along the arme; The two *Benders*, the inſide or fore-ſide, and the two or three extenders the outſide or the backeſide. But theſe Muſcles which are ſeated in the cubit it ſelfe do ſerue to mooue eyther the Wand, or the VVreſt, or the fingers.

The 1 Bender

The firſt *Bender* is called *Biceps* [Tab. 18. fig. 1,2,3. and Tabl. 10. fig. 1, and 2 ^A] or the double-headed muſcle, becauſe it hath a double beginning and theſe very ſtrong ſtanding off one from another to giue way to the Nerue of the arme and the inſertion of the muſcles of the ſame. Theſe originals doe ariſe from the ſhoulder-blade, but are couered by the ſecond muſcle of the arme called *Deltoides*. [tab. 18. fig: 1 ^M at fig: 3, ^N they are vncouered]

The ſituation of this Muſcle is on the inſide of the arme, and in thoſe bodies that are fleſhy or brawny it may be perceiued vnder the skin before diſſection. Of theſe two originals the one is outward [Tab. 19. fig: 1 ^n] which is neruous and round, ariſing out of the vpper brow of the cup of the ſhoulder blade, and is deriued vnder the Ligaments of the ioynt of the arme and aboue the head of the ſame through a fiſſure or clefte made of purpoſe for this vſe.

The other originall [tab. 19 fig: 1 °] is partly Neruous, partly fleſhy, broader alſo then the other ariſing from the proceſſe of the blade-bone which is like vnto an Anchor, and led aboue the head of the arme a little vnder which head it is vnited with the former [tab 19. fig: 1 & 2 ^P] and ſo they make one thicke, ſtrong liuid muſcle almoſt rounde and furniſhed with right fibres.

A fleſhy portion accounted for a particular muſcle.

A fleſhy portion of this muſcle is inſerted into the middle of the Hande, where the bone hath a priuate aſperity by which it is lift vp. This portion (ſayth *Columbus*) to a man that is not ſharpe ſighted ſeemeth a diſtinct muſcle drawing the arme to the breſt, of which portion alſo *Veſalius* and *Laurentius* haue made mention, but not *Falopius* or *Archangelus*, but *Arantius* ſomwhat boldly propoundeth it for the eight muſcle of the arme and indeede departing from the arme and climbing ouer another muſcle it beareth the forme of a round and fleſhy muſcle, and a little aboue the ioynt of the cubit becomming more ſinnewy it endeth into a ſtrong, thicke, round and neruous Tendon, and being moderately dilated is inſerted into an inwarde eminence and protuberation of the *Radius* or *wand*, created onely for the inſertion thereof. It groweth alſo ſomewhat to the ligament of the Ioynt. [Tab. 19. fig. 1, ^g] This Muſcle as alſo the ſecond hath right fibers, wherfore with the ſecond it bendeth the cubit ſtraight inward.

The 2 Bendes

The ſecond *Bender* is called *Brachiæus* the muſcle of the arme [Tab. 18. fig: 2,3,4. tab. 19. fig. 1,2,3 ^R] It lyeth vnder the former is ſhorter then it and wholy fleſhy, and embraceth very cloſely the lower and middle part of the length of the arme vnto which alſo it groweth. It ariſeth from the bone of the arme in that place where the Muſcles of the arme are inſerted about the middle of the length thereof on the outſide. His beginning is fleſhy and twofold, [Tab: 21, fig: 2,3, V] and in the middle reſembleth an obtuſe angle. Preſently after it becommeth thicker and groweth ſtrongly to the arme, and deſcending downeward fleſhily couereth the foreſide of the Elbow repreſenting a little hillocke, and is ſtrangely infixed or inſerted larger and more fleſhy into the forepart of the Cubite or Ell, and the *Radius* or Wande, and the Ligament of the ioynt, [tab. 21. fig. 2 ° fig: 3, °] to bend the cubit in a ſtreight line.

The third.

The third muſcle of the cubit or the firſt *Extender* called alſo the long muſcle [tab. 28

fig.

C, The insertion of the wormy muscles into the first bone of the Fingers.

d e f 3, portions of the tendons cut of neare vnto their insertion, whereof *d* is the insertion of the Muscle growing to the Tendons, *e* the insertion of the first muscle bending the Fingers, and *f* of the second.

b 2, the corner of the shoulder blade whereinto the fourth Muscle of the blade called *Lenator* or the heauer, noted in the tenn: precedent tables is inserted.

s 2, the higher processe of the shoulder or the top of the shoulder.

k 2, the insertion of the vpper blade rider.

l 2, the lower processe of the shoulder blade.

n 1,2, The outward neruous head of the muscle called *Biceps*.

o 1,2, his neruous head.

p 1,2, the coition or meeting of these two nerues

q 1,2, the tendon of this muscle.

f 2, A part of the *Supinator* or the muscle which bendeth the hand vpward where it goeth from the arme vnto the cubit.

t 2, his broade tendon inserted into the appendix of the wand.

u 2, the beginning of the second muscle bending the foure Fingers.

A 1,2, the *Biceps* or the first muscle of the cubite which hangeth vppon the fourth from his insertion.

B 1,2,3, the 2. muscle of the cubit called *Brachiæus*.

C 1,2,3, the 3 muscle of the cubite called *longus*.

E 1, the muscle in the palme of the hand whose broad tendon is at *μ*.

F 1,2, the first muscle bending the foure Fingers hanging down in the second Figure.

G 2,4, the second muscle bending the foure Fingers hanging in the fourth Figure, *β* sheweth his tendons.

H H 2, the muscles called *Lumbricales*, their insertion are *c* in the 4. Figure.

f 2,4, the first of those that bend the thumbe, in the 4. it dependeth from his insertion, and his tendon is at *ε*.

Table 19. sheweth the Muscles of the Cubit, the Wand and the Fingers.

TABVLA. XIX.

FIG. I.

K 1,2, the second bender of the thumbe. L 2,4, the 3. bender of the thumbe. N 1, the muscle *Deltois* inuerted. the vpper N in the third Figure, the muscle called *Latissimus*, the tendon of the third muscle of the arme. The lower N in the 3, and 4. Figure; the *Vlna* or Ell without flesh. O, the vpper in the third Figure, the fourth greater round muscle of the arme. o, the lower 3,4, the wand bared. Q 3, the vpper Blade rider whose insertion is at *f*; 2, K. R 3, the Blade-lurker whose insertion is at *a*. S the vpper 1, the lesser Saw, *n θ* his amplitude whereby it groweth to the ribbs. 1, the place where it groweth to the shoulder blade. S the lower 1,2, the thicke muscle of the little Finger, or the fourth muscle of the extenders. X 1, the third extending muscle of the thumbe. X 2, the place where the muscle noted with G is diuided into foure fleshy parts. *β* 4, the tendons of the second muscle bending the foure Fingers. *γ* 2, the place where the tendons of the second muscle doe abide. *δ* 2, the place where the tendons of the first muscle remaine. *ε* 2, the tendon of the first muscle bending the thumbe inuerted with the muscles in the hand. *n θ* 1,1, the amplitude of the greater Saw whereby it is ioyned to the ribs. *n n* 2, the muscles of the Fingers growing to the foure tendons of the second muscle in the hand which are called *Lumbricales* or the worme muscles. *ι*, 3, where it groweth to the angle of the shoulder blade. *λ* 1, the beginning and insertion of the bender of the wrist. *μ* 1, the tendon of the muscle of the palme of the hand. V 1, the transuerse ligament. T 1, the muscle called *Interossæus* or the slender muscle of the little Finger in the palme of the hand. Δ 1, The first muscle bending the wrist. Θ 1, The second muscle bending the wrist here hangeth downe. Π 1,2,3, the first *Supinator* of the *Radius* or wand, in the 3. Figure hanging from his implantation. Φ 3 4, the first *pronator* of the wand or the square muscle. Ω 1,2,3,4, The round *Pronator* of the wand. Character 1,2,3, in the fourth Figure, the fourth 5. and 6. muscles bending the thumbe. * a ligament going betweene the Ell and the Wand.

His originall. fig.2,3,4.Tab.19,fig.1,2,3.and in the other figures at c] runneth fleſhy and with right fibres through the backſide of the arme. It ariſeth with a ſtrong and broade originall, partly neruous and partly fleſhy from the lower rib of the blade bone a little vnder his necke, where it hath a particular boſome or cauity to couch it ſelfe in,and deſcending directly downeward,it groweth very fleſhy to the inſide of the arme, or rather it is increaſed with a fleſhy portion [Tab.21,fig.1,λ] bred out of the arme as it were with another originall, which is mixed therewith to giue it ſtrength: with which portion being augmented it deſcendeth directly downeward, (that fleſhy portion euen to his end growing to the arme) and becomming partly neruous on the outſide,partly fleſhy on the inſide,is inſerted into the inner ſide of the backe-ward proceſſe of the Cubit called *Olecranon*; *Archangelus* ſaith it is inſerted into the *exterior* part of the *Radius* where it hath a cauity inſculped for it.

Augmentatiõ

Inſertion and vſe. The vſe of of this muſcle is together with that that followeth directly to extend the Cubit; *Archangelus* addeth that it lifteth it alſo vpward.

The fourth. The fourth muſcle or the ſecond *extender* called alſo the *ſhort* muſcle, [Tab.18,fig.4. Tab.20,fig.1,and 2,n] occupieth the outward part of the back-ſide of the arme. It ariſeth with a neruous originall, (and double ſaith *Columbus*) from the backſide of the neck

His originall.

Progreſſe. of the arme and becomming fleſhy before it hath ouercome the middeſt of the length of the arme it is ſo mingled with the former that euen vnto the inſertion it can by no means be ſeparated therefrom, ſo that it may ſeeme to be but one muſcle or one body compacted of three muſcles, whereas notwithſtanding in truth they are two; for this fourth muſcle is very ſtrongly inſerted [Tab.18,fig.4,x Tab.20,fig.1, and 2,x] into the outſide of the poſterior proceſſe of the Cubit,where it is partly fleſhy, partly neruous,eſpecially about the point wheron we leane with our elbowes,which ſinewes haply is the reaſon why at ſome times leaning hard vpon the pitch of the elbow,we find a kind of benummednes or painefull ſenſation like the ſleepines of the legge to run along our arme both vpwarde and downeward.

Inſertion.

Fibres & vſe. This fourth muſcle as the third,hath right fibres, wherefore alſo it extendeth or ſtretcheth out the Cubit directly, *Archangelus* addeth alſo downeward. But in dogges and

Munkies. Munkies and other Creatures which reſt themſelues much vpon their forefeet, there are three very conſpicuous extending muſcles,beſide one very ſmall,found in Munkies (but by *Galen* pretermitted ſaith *Veſalius*) which runneth from the ſhoulder-blade to the Cubite or Ell.

The actions of the muſcles of the cubit. So then in theſe muſcles of the Cubit the primary action is euident, which is contraction,and the ſecondary which is relaxation:when the *bending* muſcles are contracted, the *extenders* are relaxed,that ſo the Cubite might be inflected with more eaſe: againe,when the *extenders* are contracted,the *benders* are relaxed that the Cubite might be better ſtretched out, and both theſe actions are performed by right motion. By accident alſo they follow the motion of the arme. Moreouer,the Cubite is moued ſidelong and round.

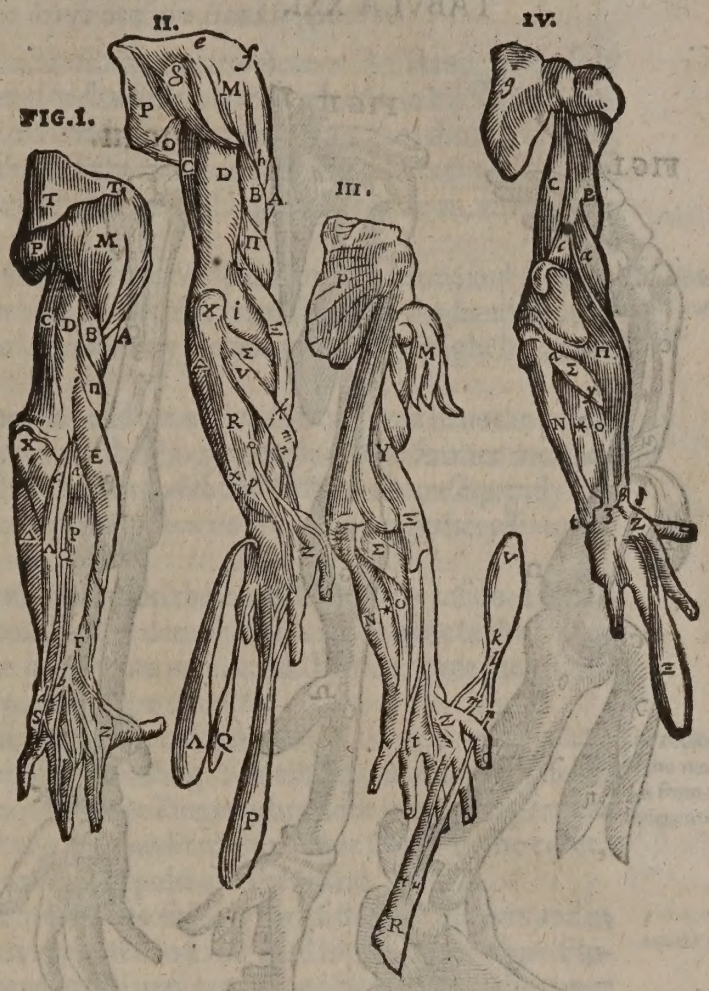
CHAP. XXVI. *Of the Muſcles of the Radius or Wand.*

The motions of the *Radius* double. THE motion of the *Radius* or *Wand* is double,for either it is moued *perſe,of it ſelfe* (the Cubit or Ell being vnmoued) by reaſon of the ioynt eyther aboue with the arme,or below with the wriſt, or both aboue and below with the articulation of the Ell; and ſo the whole hand is mooued eyther downeward or vpward, (for the whole hand being ſuſtained almoſt alone by the *Radius*, hath one and the ſame motion,and therefore is turned vpward by the aſsiſtance of two externall muſcles; and downeward by two internall, by which alſo it is turned about.) Or it is moued by accident with the Ell in a right line when the whole Cubit is bent and extended. There are therefore foure muſcles of the *Radius*, two called *Supinatores* which turne the palme of the hand vpward, and two called *Pronatores* which turne the palme downeward.

The firſt Supinator. The firſt Supinator which is the ſecond of the Wand according to *Veſalius* (who calleth it alſo the *exterior*) *Fallopius* and *Platerus*,is alſo by *Laurentius* called *Supinator longior*, [Tab.18,fig.1,2,3,and Tab.19,fig.1,2,3.and Tab.20,fig.1,2,4,π] becauſe in reſpect of his belly it is the longeſt of all thoſe muſcles which run along the Cubit. It ariſeth fleſhly from the edge of the outward and vpper protuberation of the arme,[Tab. 19, fig.2,ſ, Tab.20,fig.4,α] afterward being dilated it is bedded obliquely vppon the Wand, and is inſerted,growing broade at his Tendon into the membranous appendix of the *Radius* toward

A,1,2, A part of the muscle called *Biceps*, or the double-headed muscle.
B,1,2.4, The higher and outward part of the muscle called *Brachiaus*.
C,1,2.4, the muscle extending the Cubite from the lower part of the shoulder-blade, others call it the fifte muscle of the Cubit.
D.1,2. The short muscle extending the cubit arising from the neck of the arme.
E, 1. The second or the two-horned muscle bending the wrist.
M 1,2,3. the muscle *Deltois* or the second of the arme.
N 3.4. The Ell without flesh.
O,1,2. the fourth muscle of the arme called *Rotundius maior*.
O 3,4, the Wand bared a great way.
P 1,2,3, the lower blade rider or the fift muscle of the arme.
The lower P in the 1 and 2 figure. the first extender of the foure-fingers, in the second figure hanging downe, whose originall is at *a* and tendons at *b*.
Q 1,2, the 2 muscle extending the foure fingers, in the 2 Figure hanging downe.
R 2,3. the thirde extender of the forefingers in the third Figure hanging down clouen into 2 parts at *op* in the 2 Fig.
S,I, the 4 muscle extending the forfingers
T, I the vpper, the fyrst muscle extending the thumbe.
V,2,3. the 2 extending the thumb.
Y,3, the originall of the 2 muscle extending the wrist.
Z, 1,2,3,4. the 4 extender of the Thumbe
a,b,1,2. the originall of the first extender of the foure Fingers from the protuberation of the arm at *a* and his tendons at *b*. *a* 4, the originall of the shorter supinator of the Wand. C 1, the originall of the fyrst extender of the wrist from the vpper protuberation of the arme. C 1, Another part of the long extender of the cubit. *d* 1, His insertion at the little Finger. *e* 2, the spine of the blade & the top of the shoulder. *f,g*. the originall of the Cowle muscle in the hinder part from the spine of the blade. *b* 2, His insertion. *i* 2, the membranous Ligament of the Wand, tying the vpper part to the arme. *i,k,l,m.n*,2,3. The vpper part of the second muscle extending the thumb marked with V. inserted into the bone of the wrist at *k.l*, the lower part diuided into two at *l*, the one vnder the wrist bone that sustaineth the thumbe at *m*, the other inserted into the thumb at n. *op* 2, The thirde extending muscle noted with R cut into two parts. *q* 4, the backe of the shoulder blade bare. *r* 2, the originall of the second extender of the wrist. *s,t* 3, the original of his horned tendon *s*, the insertion *t*, *x*, 1,2 A place of the Ell without flesh. Δ 1,2, the first bender of the wrist. Λ 1,2, the first extender of the wrist. *m* in the 2 Figure hanging, whose originall is at *c* and insertion at *d*. Π 1,2,4. the fyrst supinator of the wand whose beginning is at *α* insertion at *β* in the 4 Figure. Σ 2 3,4. the shorter supinator of the *Radius*, whose beginning at *α* his insertion at *γ*. Ξ 2,3,4, the second muscle extending the wrist. *α,β* 4, the beginning of the fyrst supinator of the wand from the arme at *α*, whose insertion at *β*. *γ* 4, the insertion of the shorter supinator of the wand. *s,t* 4. A place where certaine bosoms are prepared for the transporting of the tendons, and containing a gristle of that place. ζ, 4, Ligaments ioyning the bones of the Wriste together, * 3.4. A Ligament in the middest betwixt the Ell and the Wand.

TABVLA. XX. *Sheweth the extending Muscles of the Arme, the Cubit, the Wand and the Fingers.*



ward the inside. [Tab. 19, fig. 2[t] and Tab. 20, fig. 4 *β*] This Muscle ouer-turnes the lower part of the wand, and so lifts the palm of the hand vpward.

The second supinator which is the shorter [Tab. 20, fig. 1. 3, 4. and tab. 21, fig: 1 Σ] ariseth fleshy. *Platerus* and *Archangelus* say from a strong Ligament which bindeth the cubit to the arme and from the vpper part of the *Radius*. *Bauhine* from the ioynt which articulateth the cubit to the arme, and from the backward processe of the Ell [Tab. 20, fig. 4[a]] which is called *Olecranon*: from thence it paceth obliquely and is implanted almost into the middest of the wand, to which also it adhereth [Tab. 20 fig: 4 *γ*] and it is on the outside membranous and on the inside fleshy. This muscle turneth the vpper parte of the wand obliquely outward and turneth vp the backpart of the hand. The second

Table 21. Sheweth some muscles of the Cubite, the Wand, the Thumbe, and those we call interossei or bone-bound Muscles.

TABVLA XXI.

q 1,2, The shoulder blade bare, & in the second figure is his *interior* part.

b 1,2,3, The second muscle of the Cubit called *Brachiæus*, whose double originall in the third figure is noted with *v* and his insertion at *o*.

C 1 Muscles extending the Cubite which are accounted by *Vesalius* three, The third at *i* the fist at *n* & the fourth at λ.

G 2, The insertion of the muscle called *Brachiæus*.

N 1,2,3, The Ell bared from the flesh.

O 1,2,3, the *Radius* also with flesh.

Q 1. the vpper bladerider inuerted.

R 2, the same superscapularis hanging downe.

X 2, Two muscles bending the second ioynt of the thumbe.

Γ 2.3, One of the muscles called *Interossei* applyed to the roote of the second ioynt of the thumbe, but in the thirde figure are the *Interossei* in the palme of the hand, which fill the distances betwixt the bones of the Wrist.

Σ 1, The short Supinator of the Wand bending downeward.

Φ 3, The square muscle of the Wand bending downe.

Ω 1,2, the round muscle of the Wand called *Pronator*, whose insertion is noted with G. This in the second figure is hung from his insertion.

θ 1, the bone of the arme altogether with out flesh.

ιυλ 1, The first muscle of the cubit at *ι*, the fourth at λ, the fist at *n*: or the three extending muscles.

μ 1, The insertion of the muscle of the Wand called *Pronater* at Ω.

νζο 2,3, V, the originall of the second muscle of the arme called *Brachiæus*, on either side his insertion in the second figure at G, in the third at O, 1.2,3, char. 1, The fourth fist and sixt benders of the thumbe, * Heere a ligament commeth betweene the Ell and the Wand.

The first *Pronator*.

The first *Pronator* which *Vesalius*, *Falopius*, and *Platerus* reckon for the first of the VVand, is called also by *Laurentius*, *Quadratus*, [Tab. 19, fig. 3,4, and Tab, 21, fig. 3, Φ] because it ariseth fleshy, broade and square, from the lower and inner part of the Ell neare the wrest, and lying ouerthwart on the foreside is inserted with a membranous tendon, (*Columbus* and *Archangelus* say fleshy) into the inner & lower part of the VVand.

His fibres.

His fibres are trausuerse and clime vp ouertwhart from the Ell vnto the VVand.

Figure.

It is a large muscle, and incompasseth al that part of the Ell and the VVand which lies directly against the inside of the Cubit. It is square and so long as the inner Region of the whole Cubit made of the Ell and the VVand. It is also euery way fleshy, and in the middle thicke & bunching, seruing in stead of a soft pillow vnder the tendons that runne vnto the fingers.

Vse.

This muscle drawing the lower part of the VVand which is next vnto the wrest inwarde, beareth downe the VVand and the hand fastened thereto into a prone position.

The second *Pronator*.

His originall progresse.

The second *Pronator* which is the third muscle of the VVand according to *Vesalius*, *Fallopius* and *Platerus*, is by *Laurentius* called *Rotundus*. [Tab. 18, fig. 1,2,3, and Tab. 19, fig. 1,2,3,4. and Tab. 21, fig. 1,2. Ω]- It ariseth fleshy from the inner protuberation of the arme and the inner side of the El where it is articulated to the arme, or as *Fallopius* hath it, from the inner ligament of that ioynt: thence it climeth obliquely ouer the inside of the VVand and is implanted with a fleshy insertion about the middle thereof, [Tab. 20, fig. 4. 2] from this insertion it runneth out neruous to the very middest of the VVand, and is infixed very strongly with a neruous Tendon to a certaine roughnes that is in the vpper

Insertion.

part thereof. [Tab. 21. fig. t. 4] As often as this muscle is contracted it leadeth the vpper part of the wand inward, and so wresteth the VVand and the whole Hand into a proane and downward position.

CHAP. XXVII. *Of the Muscles of the Hand in generall.*

Galen considering the admirable frame and structure of the Hand, because it is as he sayth the *Instrument of Instruments*, intreateth of it in his first Bookes *de vsu partium*. *Columbus* in the last place, because (sayth he) the wonderfull and miraculous frame thereof might remaine infixed in our memories, but we will discourse of the Muscles thereof in this place, because we will follow the order of dissection.

The muscles of the hand double.

Seeing therefore that the proper action of the Hand is Apprehention, and Apprehention a Motion depending vpon our will, it was also necessary that the hand should haue muscles which are the instruments of voluntary motion whereby it might be mooued altogether and euery finger apart.

The muscles therefore which moue the hand are of two sortes, some haue the guide of the motion of the whole Hand, others moue the Fingers onely. The former are likewise of two sortes; for some doe either bend or extend the VVrist, and consequently the Hand with the same motion, others mouing the *Radius* or VVand do together also turne the Hand downward or vpward.

These Muscles are seated vpon the cubit either on the outside or on the inside. Hither also may we referre that Muscle that moueth the skin which is in the palme of the Hand. These that moue the Fingers doe either bend them or extend them or moue them sidelong, that is, ioyning them together or parting them asunder.

The reasons of the motions from the articulations.

But because the thumbe which is called *Pollex*, for that it is æquipolent or æquiualent to the whole Hand, hath in his bending and extending something peculiar to himselfe, differing from the same motions in the other foure Fingers, therefore it hath his peculiar Muscles, as also the rest of the Fingers haue theirs, whereof some are seated in the cubit, others in the After-wrist and others in the ball or palme of the Hand.

Againe, because the articulation is diuers in the first ioynts of the fiue Fingers and in the second of the Thumb, from that it is in the second and third ioynts of the foure Fingers and the third of the Thumbe, because the latter are ioyned by *ginglymos* the vpper bone receiuing into his bosome the protuberation or swelling of the lower, and the lower bone into his cauity the heads of the vpper: hence it commeth to passe that their motion is onely simple, absolued by extention and flexion without any inclination to either side: but the first bones of the foure fingers and the first of the thumbe being fastned by a firme articlation to the bones with which they are sustayned, are not onely bent and extended, but inclined also to the sides as they are led to-ward or fro-ward the thumb.

I could busie my selfe and you too in setting downe each Authors diuision of the muscles of the Hand, for euery one almost differs from another, but because the History that followeth dependeth most what vpon *Bauhines* relation, therefore we will remit him that is desirous to know each mans minde vnto their proper discourses, & content our selues with *Bauhine* alone.

40. muscles of the hand. How seated.

In the whole summe therefore the Muscles which mooue the Hand are forty; foure of the wrist, foure of the wand, of the palme of the hand three sometimes foure, and 29. of the fingers.

Some of these Muscles were seated in the cubite because it was very necessary they should be large, and their tendons onely are transmitted vnto the fingers. For if they had beene placed in the Hand they must needs haue increased the bulke thereof to that quantity which would haue been preiudiciall to the vse of so excelent an organ. Notwithstanding some are situated in the Hand.

The vse of the 40. muscles.

Of these Muscles there are nine benders, two bend the foure fingers and seauen the Thumbe. The extenders are 20. sixeteene extend the 4. fingers, in which number are those foure called *Lumbricales* the VVormy muscles, and those eight called *Interossei*, because they lurke betweene the bones. The other foure extenders doe serue the thumbe which they doe either simply extend or leade to the fingers or from the fingers: the tendons of which foure muscles as *Galen* obserued in the 17. chapter of his sixt Booke *de vsu partium*, are infixed in the ioynt of the bone that is to be moued. But because in dissec-

tion wee meete firſt with the muſcle which is called *Palmaris*, therefore in the firſt place we will intreat of it.

CHAP. XXVIII. *Of the Muſcle of the Palme, and 2. or 3 other, iſſuing from the fleſhy Membrane.*

THE Muſcle of the palme ſo called by *Laurentius* and *Bauhine* lyeth vppon all the interior Muſcles of the Hand. [Ta.22.fig.1.2.Ta. 23.fig.1.ª] It is ſeated in the cubit and is neruous and round, ariſing with a neruous beginning from the ſharpe poynte of the inner protuberation of the Arme; leaneth vppon and groweth to the middeſt of two muſcles which bend the wriſt, [Ta.22.fig.1.Δ⊙] and proceede out of the ſame protuberation with it. Preſently after his originall it becommeth fleſhy, yet is the belly of it but ſmall, and before it attaine vnto the middle of the cubit it paceth ſomewhat obliquely, afterward it is againe attenuated and groweth ſmall or ſlender and determineth into a round, narrow, and long tendon [Ta.23.fig.1.μ] which riding ouer the inner Ligament of the wreſt, paſſeth vnder the skinne, and his tendon in the ball or palme of the Hand is dilated, attenuated and groweth to the skinne, yet ſo that it lyeth not vnder that part of the skinne which couereth the muſcles in the hillocke of the thumbe [Ta.22.fig.3.vnder p] and thoſe which leade the little finger from the reſt. [Tab.22.fig.1.and 3.S] Finally, it is ioyned with ſo ſtrong and fibrous tyes to the rootes of the Fingers, that although there be a certain fat, or ſubſtance like vnto it, (of which *Galen* maketh mention) comming betweene, yet you can ſcarce ſeparate the skin of the hand from the ſinewy thinneſſe of this Tendon.

His original progreſſe.

Inſertion.

Vſe. The vſe of this muſcle is firmely to corrugate or contract the skinne of the palme when we would hold any thing faſt, for by that meanes the skinne becommeth immoueable, which if it ſhould moue, we could not hold a thing ſo ſteddily or ſo ſafely. Haply alſo this Tendon is the cauſe why the skin of the palme hath more exact ſenſe then the skin of the whole body: not that ſo quicke ſence is giuen to the hand by this Tendon, but becauſe of the foure nerues which run vnto the foure fingers.

[*Table 22. is the ſame with Table 18, Folio 778.*

Fallopius his obſeruation. *Fallopius* thrice or foure times found this muſcle ariſing out of the ſame place in each arme double, whereof one did end into a broade Tendon, the other was inſerted into the tranſuerſe ligament of the wreſt, on the contrary *Veſalius* ſaith that hee found more then once the fleſhy part thereof wanting, and then the broade Tendon was made of a portiõ of thoſe Tendons that bend the wreſt, [Tab. 22, fig.1, Δ⊙] before they aſcend vnto the ſame. Sometimes alſo (ſaith *Bauhine*) the broade Tendon is produced from an interall tranſuerſe ligament which runneth ouer the Tendons of the wriſt, which alſo *Columbus* obſerued in the diſſection of ſome theeues.

A muſculous ſubſtance ariſing from the fleſhy pannicle. The formes of it. The fibres. Beſide this muſcle of the palme in the beginning of the inſide of the hand at the lower part of the hillocke called by ſome *Mons Lunæ*, by ſome *Mons Martis*, by others *Veneris*, but we will cal it the Mountaine of the Moone, where the eight bone of the wriſt is ſeated, there is found a certaine fleſh. It proceedeth out of the fleſhy pannicle, or from the membrane of that muſcle which frameth the foreſaide Mountaine of the Moone. This fleſh carrieth the forme ſometimes of two, ſeldome of three ſlender and ſhort muſcles. It hath tranſuerſe fibres and runneth to the middle and inner part of the ball of the hand, and is implanted at the broade Tendon of the palme muſcle, where it receiueth a complication with the fleſhy panicle which in that place is fatty.

His vſe. The vſe of this fleſh is in great contractions of the palme to draw the Mountaine of the Moone to the middle of the hand, when wee would make it as hollow as wee can, or elſe to binde in the two hillocks at the thumbe and the little finger for the ſame vſe. Of this muſcle, if ſo you will call it, none of the Ancients made mention, but it was firſt found by *Iohannes Baptiſta Conanus* & firſt deſcribed in print by *Valuerda* who yet miſtaketh the vſe, for he ſaith it was made for extention.

CHAP. XXIX. *Of the ſubſtance which commeth betweene the skinne of the palme and of the fingers and their Tendons.*

BEtwixt the Tendon and skinne of the Palme and the inner ſide of the fingers there appeareth a certaine fleſhy ſubſtance like vnto fat, of which it ſhall not be amiſſe a little to diſcourſe. Although the whitiſh colour it hath and the hardnes do more reſemble fat then fleſh, yet we conceiue that it may more fitly be referred to a kinde of fleſh, as well becauſe it is full of ſinewy fibres,

as alſo becauſe there are many ſmall and threddy Veines diſſeminated there-thorough. Add alſo that though a man be neuer ſo much extenuated or conſumed yet there alwaies remaines ſome part of this ſubſtance, whereupon it is that *Galen* cals it fleſh, and the *Arabians* thought it to be a kinde of ſimple fleſh different from the body of a muſcle. It may be obiected how then comes it to be ſo hard? I anſwere, by the contaction of the bones and of the Neruous parts which lie vpon it, and therefore it is like the fat which ioyneth vpon the ioynts of the bones. The vſe of this ſubſtance is to be as it were a pillow or bed whereon the many propagations of ſinews might lie ſoft which were deriued from greater Nerues to make the hand of exquiſite ſenſe. Such a ſubſtance alſo is found betwixte the Tendons that bend the fingers and their skin, leaſt when we are conſtrained rudely to take hold of any hard ſubſtance the tendons ſhould be preſſed or otherwiſe offended, for which cauſe alſo it is very plentifull vnder the skin of the ſoale of the foote, yet it is to bee noted that there is leſſe ſtore of it about the Ioynts leaſt it ſhould hinder their *Motion*, eſpecially when they bend into an acute Angle.

That it is fleſh not Fat.

In like manner in the ſides of the Fingers, there is ſome of this fleſh to fill vp the ſpaces betwixt the Ioynts which otherwiſe would haue bene hollow, becauſe the ſide knuckles at each bone doe ſtand ſomewhat out from the length of the bone, which equalitie was not onely made for ornament but rather and more eſpecially to make the Hande as we ſay thight, that is able to holde a liquid ſubſtance when we gather our Fingers toward the Palme to make *Diogenes* cup. Finally, this ſubſtance is very profitable in the toppes of the fingers for better apprehenſion, for if nothing had bene placed vpon the extremities of the bones which might yeelde a little when wee offer to take holde; ſurely the bones would haue bene in danger of breaking, and beſide wee could not haue gotten holde of many things which now we do by the helpe of this ſubſtance and the Nailes.

In what parts of the Finger this ſubſtance is.

CHAP. XXX. *Of the Muſcles which bend and extend the foreſingers.*

WE ſaide before that there were two Muſcles which did bend the foreſingers and 16 that did extend them. The firſt Bender [tab. 22. Fig. 4, ᵗ] ariſeth with a round [ⁿ] beginning and large, mixed of a fleſhy and Neruous ſubſtance, from the internall protuberation of the arme vnder the heads of the Palme-muſcle [tab. 22 Fig. 1 and 2ᵗ] and thoſe two which bend the VVriſt, [Tab. 22 fig: 1, △, ⊙] Afterward becomming broader, it paſſeth thorough the middle and anterior part of the Ell and the VVand, and becommeth fleſhy and round, yet before it attaine vnto the roote of the VVriſte his Venter or Belly is anguſtated or ſtraightned, [tab. 22. Fig. 3 °] and diuided into four fleſhy parts, all which do determine into tendons exquiſitely neruous and tranſparant: and being together involued in one common, thin and mucous membrane; for their more ſafe progreſsion doe paſſe along vnder the annular or round Ligament [tab. 23 Fig. 1 V] which is ſeated ouerthwart the wriſt; and at the ſecond bone of the foreſingers nere the middeſt of the Ioynt are diuided with a long Section or ſlit through which the tendons of the next muſcle to be deſcribed (which lyeth vnder them) which were to reach vnto the third Ioynt are tranſmitted. There they become broader that they might mooue more eaſily and apprehend or take holde the better, and a little after the diuiſion or ſection they are inſerted into the ſecond bones of the foure Fingers. And truly this progreſſe and inſertion of theſe muſcles is an admirable and ſtrange worke of Nature: for they are ſo ſeuered, that the fingers in their motion might orderly follow one another, and each of them alone bend inward.

The 1 Bender of the foreſingers.

An admirable worke of Nature.

Moreouer, as they creepe vp the firſt bones of the Fingers they are rowled about againe with a tranſuerſe Ligament, which Ligament ariſeth out of the inner parte of the bone and maketh a kinde of Trough, wherein the tendon of this firſt bending muſcle, together with that of the ſecond muſcle vnder it, might ſecurely paſſe along the length of the Finger and holdeth it faſt leaſt it ſhould depart from his owne ſeate and ſo decline from his owne finger againe; that when it is contracted it ſhould not ſtrut or ariſe vp, eſpecially when we bend the ſecond or third ioynt of the fingers. For were it not for this tranſuerſe Ligament which ſtreightneth or bindeth the tendons in the place before named, they would not in their contraction bee curued backward but would ariſe vppe like right Chords, lift vp the skin and fill the ball of the hand, whereas the Ligaments although the tendons be contracted do yet keepe them cloſe vppon the bones into which they are not infixed, and ſo the way ouer the Ligament is ſmooth and euen.

The tranſ. uerſe Ligament.

The

The vſe of this Muſcle is primarily to bend the ſecond ioynt, ſecundarily alſo the firſt, becauſe in the paſſage they are firmely faſtened together by the interpoſition of membranes and fibres, and indeed the firſt ioynt hath no other Muſcle allotted for his flexion ſauing this onely.

the 2. *Bender.* The ſecond *Bender* which *Laurentius* calleth *Muſculum profundum*, the Deep Muſcle, lyeth behinde the former [Ta. 23. fig. 2. 4.ᵉ] being in his whole courſe, body and Tendons ſubiected vnder it euen to his inſertion. It ariſeth a little lower then the former from the proceſſe of the Ell on the foreſide thereof, [Ta. 23. fig. 2.ᵃ] and is ſtronger then it, becauſe his motion is greater and of more moment. It is exactly fleſhy and broade, occupying the middle part of the cubite and groweth both to the Ell from which it taketh ſtrength, and alſo to the Ligament which ioyneth the Ell to the Wand, and ſeparateth the interior muſcles from the exterior; but when it is deſcended lower thē the middle of the cubit, it is anguſtated or groweth narrower [Ta. 23. fig. 2. x fig. 4.ᵇ] and diuided into foure fleſhy partes which are couered with a neruous coate and by degrees bring forth neruous and round tendons which perforate or make way through the Tendons of the former muſcle. All theſe Tendons paſsing vnder the tranſuerſe and membranous Ligament of the wriſt, are euery one of them in the ball of the hand inueſted with proper membranes which are ioyned to the Tendons by neruous tyes. Afterward they creepe vnder the foure Ligaments of the fingers, and paſſe thorough the holes or diuiſions of the Tendons of the firſt Muſcle, [Ta. 23. fig. 2. γ δ] that ſo they may bee implanted into the third ioynt, yet a little before their inſertion they become broader, and in olde men there is found a little bone like the *Seſamum Seede*, or like that wherwith we feed Canary Birds, which hath the ſame vſe and forme that the Patell bone or whirle bone of the knee, for as theſe ſmall bones do grow to the tendons of the firſt muſcle, ſo they alſo growe to the Tendons of the ſecond muſcle before they are inſerted into the third bones of the fingers.

The vſe of this Muſcle is to bend the third ioynt of the foure fingers, yea which is more as *Arantius* hath obſerued, it ſeemeth to contract twelue ioyntes, becauſe in his paſſage his tendons are affixed to the firſt and ſecond ioyntes by their membranous Ligaments. And indeed if we obſerue the motions of our hands well, when we would moue the third ioynt, the two former are curued whether we wil or no, whereas the third and the ſecond may be bent when the firſt is immoouable and extended: and thus much of the Muſcles which bend the foure fingers.

The extending muſcles of the fingers, called *Vermiculares.* The extending Muſcles are 8. beſide the *Interoſſei* of which wee ſhall intreat afterward: of theſe the firſt, ſecond, third and fourth [Ta. 23. fig. 2. ν ν] are called *Lumbricales* or *Vermiculares*, that is, the wormy Muſcles, and doe cleaue to the ball or palme of the hand. They are fleſhy, ſmall, round and long, and doe lie vnder the tendons of the ſecond muſcle which bend the third bone of the foure fingers. They ariſe at the inſide from thoſe membranes of the Fingers which we ſayd euen now did inueſt the foure tendons: neither let it ſeeme hard that I ſay they ariſe from membranes, becauſe the muſcles alſo of the eie take their beginning from membranes. Afterward they runne along the finger on the inſide, and with a neruous and ſmall tendon they do adhere to the tendons of the Muſcle next to be deſcribed, which extendeth the foure fingers. Their inſertion is made about the middle of the firſt ioynt into the ſecond. Wherefore when theſe muſcles are contracted to their originals, the ſecond and third ioynts of the fingers, together with the help of the Muſcles called *Interoſſei*, are primarily extended, although the Fingers alſo are extended by accident, that in great conſtraynts they might ſerue to aſsiſt oblique motions. For becauſe the Tendons of theſe Muſcles in their paſſage to their exterior part of the Fingers are tyed to the laterall or ſide-ligament of the firſt ioynt, they are able alſo with a ſlender motion to leade the firſt knuckle vnto the thumbe: and becauſe the tendons of the next muſcle to bee deſcribed are ſeated on the outſide and therefore obnoxious to outward iniuries, Nature placed theſe on the inſide that if by miſhap the outward Tendons were violated or wounded, yet the fingers by the helpe of theſe might bee extended, and this is the manner of the poſition of the firſt foure extending muſcles.

[*Table* 23. *is the ſame with Table* 19. *Folio* 781.]

The 5. extender. The fift *Extender* [Tab. 24. fig. 1. and 2. at the lower p which in the ſecond figure hangeth downe] ariſeth with an originall mixed of a fleſhy and neruous ſubſtance [ᵇ] from the outward protuberation of the arme. Afterward it becommeth more fleſhy, and deſcending

scending in the hinder part betwixt the Ell and the VVand, is neere the wrest aboue [b] much narrower, and for the most part clouen into three, rarely into foure fleshy partes, which presently degenerate into neruous Tendons exquisitely round for their better security; which Tendons are tyed together by a membranous ligament arising from the appendix of the VVand & so are together conueyed through a cauity exsculped or wroght in the externall part of the VVand into the wrest. And least these Tendons should at any time fall out of that cauity, or when the muscle is contracted, strut vp as we see a broken veine doth, they are inuolued with an annular or round ligament. [Tab. 22, fig. 2, and 4, charact. 3]. Presently after vnder the wrest they recede or depart one from another, remaining no more round, but becomming broad because the bone on the outside is round of it selfe: and one runneth vnto the second and third ioynt of the fore-finger, another of the middle finger, and the third of the Ring-finger. And hence it is that we feele so great paine if any thing get betwixt the nayles and the flesh. Sometimes it is diuided into two Tendons onely, which are inserted into the fore and middle fingers.

Insertion.

The cause of peine vnder the naile.

The vse of this muscle is to extend the second and third ioynts of those three fingers. And the Tendons of it are long, for the bellies do not reach vnto the wrist, that the hand might be lighter and more slender for agility in his motion.

The vse.

The sixt *extender* [Tab. 24, fig. 1, and 2, ⁸] is slender and long, hauing a sharpe and neruous originall, which it taketh from the same protuberation of the arme with the former, afterward becomming fleshy it is mingled with the former vnto the middle of his belly, so that in their originall they seeme to be but one muscle. It passeth along the Cubit through a cauity common to the Ell and the VVand, and running vnder the transuerse ligament is sometimes diuided into two neruous and round Tendons, sometime it remaineth single. If double, one is implanted into the *posterior* part of three bones of the Ring-finger, the other becomming broader is fastened into the backepart of the 3 bones of the little finger.

The sixt *extender*.

His originall.

Implantation.

His vse is to extend these fingers and to leade them a little outward, especially the little finger.

Vse.

The seauenth *extender* [Ta. 24, fi. 2, and 3, ⁸] lyeth vnder the two former, & ariseth exactly fleshy from the middle of the Ell where you shall meete with a long and rough line made of purpose for the rise of this muscle: thence it descendeth obliquely vnto the *Wand* and climing ouer the appendix of the wrest is diuided into two tendons, [ta. 24, fig. 2, ° P.] which are transported through a proper cauity in the appendix of the *Wand* and vnder the transuerse ligament. [Tab. 22, fig. 2, 3. charact. 4.] The vpper of these Tendons is inserted at the roote of the forefinger for the most part, more rarely at the roote of the thumb; the lower is inserted at the roote of the middle finger, sometimes onely saith *Fallopius* of the fore-finger: both their insertions are oblique, and indeed the whole course of the muscle is oblique. Their vse is to extend those fingers into which they are inserted: beside, that in extending the fore-finger, it also leadeth it from the Thumbe.

The seauenth *extender*.

His originall.

Implantation.

Vse.

The eight *extender* which is also the last, (not accounting the *Interossei* in this place) [Tab. 22 fig. 1, ˢ and Tab. 24, fig. 1, ˢ] is seated within the hand. It ariseth short, strong, and fleshy from the fourth bone of the wrest, and passeth by the lower part of the *Afterwrist*, so ascending vnto the roote of the little finger to the outward side of the first bone, in which it is inserted slender and neruous. His vse is to extend the little finger, & withall to leade it from the rest of the fingers when we desire to comprehend any round forme as a Ball or a Globe in our hands. This muscle resembleth the fashion of a Mouse, because in the beginning and the end it is slender, but in the middest round and thicke.

The eight *extender*.

His originall.

Implantation.

Vse.

And these are all the eight extending muscles. There are also eight more *extenders* (for we reckoned sixteene in the end of the 27 chapter) called *interossei*, of which we will intreate in the next chapter saue one, because the method and order of dissection requires that we should first speak of those muscles that bend and extend the thumbe.

The *interossei*.

CHAP. XXXI. *Of the Muscles that bend and extend the Thumbe.*

WE saide before that there were seauen muscles which did bend the Thumbe, & foure that did extend it.

The first bender of the Thumbe, [Tab. 23, fig. 2, and 4. ⁱ] is seated in the Cubit, and beareth vpon the second bending muscle of the foure fingers, [Tab. 23, °] to which it is a little continuated at the ioynt betwixt the arme and the Cubit, but they cleaue together in their whole progresse.

The 1 bender

It

It ariseth with a round and fleshy originall out of that part of the Ell which is nexte the ioynt of the Cubit where it receyueth the head of the *Radius* or wand, and so it runneth along the wand to which it groweth throughout as if the whole length of the wande did minister vnto it a continuated originall.

Moreouer, it getteth an additament or encrease by a portion it receyueth from the Membranous Ligament [tab.2.3.fig.4 *] & then running on to the wrist it determineth into a round and neruous tendon which together with the two benders of the foure Fingers creepeth vnder the annular Ligament of the wrist to whose side also it is fastened. In that place it is couered with a propper mucous or slimy membrane and is hidden betweene the muscles which bend the first and second bone of the Thumbe in a cauitie of a bone of the wrist which sustained the thumbe and hollowed onely for this tendons sake. Afterward it is receiued vnder the transuerse ligament of the second bone of the thumbe and dilated into his third ioynt where it is very strongly inserted and serueth to bend it. This muscle is thicker then that which bendeth the second finger, because the thumbe is of greater strength and magnitude then the rest of the fingers. In Munkeyes (sayth *Bauhine*) this Muscle is not found, yet *Vesalius* describeth a Substitute for it.

Progresse.

Munchies.

The 2. Bender

The second Bender of the thumbe [tab.23.fig.1 and 2 ᴷ] ariseth fleshy from the vpper part of the annular or transuerse Ligament which is in the wrist, [tab.23.fig.1 V] and is fastened to all the inner region of the first bone of the thumb, to which also it is fleshily inserted, yet obscurely; it toucheth also the second bone.

The 3. bender

The third Bender [tab.23.fig.2 4.ᴴ] lyeth vnder the second and is farre lesse then it. It ariseth partly out of the same place with the former, partly from that bone of the wrist which lyeth vnder the thumbe and is inserted into the root of the first bone of the thumb as farre as his middle. These two last described muscles doe bend the first ioynt of the thumbe and together with the third extender of the thumbe do make that mountainet or hillocke of flesh which is seated at the roote of the thumbe.

The vse. of 2 and 3.

The 4. bender

The fourth Bender [tab.23.f.4.char.1,2,3. do note this muscle with those that follow next] ariseth with a slender and broad originall from that bone of the After-wrist which lyeth before the fore-finger, from thence it proceedeth fleshy yet somewhat narrower, & is inserted with a membranous tendon into that side of the second bone of the thumb which is next the fore finger.

The fifth.

The fift Bender toucheth the former: is answerable to it in his originall, and being fleshy proceedeth out of the middle part of that bone of the After-wrist which lyeth vnder the middle finger. Some part of it also toucheth that bone which lyeth vnder the Ring-finger, and becomming fleshy is inserted with a small tendon into the middle of the second bone of the thumb on the inside.

The sixth.

The sixt Bender ariseth somewhat broad from that bone of the After-wrist which sustaineth the ring-finger, and is inserted into the same place with the former: sometimes also it proceedeth with a neruous original from the bone of the After-wrist which is vnder the little finger where it is ioyned with the wrist.

[*Table* 24. *Is the same with Tab.*20. *in fol.* 783]

The position of the 4.5.6.

These three muscles seated vnder the *line of life*, haue a semicircular and distinct original but yet do all determine into one and the same tendon which is tyed to the inner Seede-bone which also is the greatest of all the seede-bones in the fingers, and is inserted into the side of the second bone of the same finger. And as those muscles which heereafter we shall call *interossei*, seated in the after-wrest are carried directly or with a straight line, so those which bend the first bone of the thumbe run somewhat obliquely, and those that bend the second ioynt of the thumbe do run almost transuerse or ouerthwart.

Their vse.

These Muscles if they be contracted together doe moone the second ioynt of the Thumbe toward the ball of the Hand. If the first of the three moone alone, the thumb is led vpward toward the fore-finger: if the second it is led vnto the middle finger, if the third then is the thumbe bent downward and toward the little finger.

The seuenth.

The seauenth Bender of the thumbe lyeth vnder these three last, and is fleshy arising from the bone of the After-wrist which sustaineth the fore-finger below the middle, euen at the iuncture thereof with the wrist. It is also ioyned as the three last mentioned, to the second bone of the thumbe hauing a transuerse position, and occupieth the space which is berwixt the thumbe and the fore-finger. The vse of it is to draw the thumbe toward the fore-finger and to lay it thereuppon. And so much of the Bending Muscles of the thumbe.

The

The *extenders* of the Thumbe are foure. The first [Tab.24,fig.1,the lower [r]] ariseth fleshy from the outside of the cubit at his rough line neare the membranous ligament [tab.24,fig.4,*] which ioyneth the cubit to the *Radius*, and passing obliquely toward the *Wand*, before it touch his appendix determineth into a round and neruous Tendon which attaineth vnto the hand through the cauity by which the by-horned muscle of the wrest doth descend vnto the ligament: and is inserted into the whole length of the thumbe on that side which is next the fore-finger as farre as to the third ioynt. His vse is, to extend the thumbe toward the fore finger, and to leade it from the wrist, and therefore moueth it side-long.

The extenders of the thumbe. The first. His originall. Insertion. and vse.

The second *extender* [Tab.24,fig.2,3,[s]] ariseth fleshy from the same line of the cubit after his length, and climing obliquely ouer the VVand, is diuided into two vnequal parts which cleaue one to another, and is seated in a proper cauity insculped or ingrauen into the appendix of the VVand, and is inuested with a peculiar ligament. [Tab 22,fig.2,and 4.charact.6.] The vpper part remaining a while fleshy, determineth into a Tendon almost round, and is implanted into the vtter side of that bone of the wrest which lieth vnder the thumbe. [t] The lower [t] is subdiuided into two fleshy portions, both which doe end into a Tendon: one of them groweth very strongly to the roote of the first ioynt of the thumbe: [m] the other with a membranous tie cleaueth close to his second and third bones. [n] His vse is to extend the thumbe inward.

The second. His original. Diuision. Implantation. Vse.

The third *extender* [Tab.22,fig.4.[x]·Tab.23,fig.1,*] ariseth with a neruous original, which presently after becomes fleshy, from the inner part of the bone of the wrest which sustaineth the thumbe. After being carried downward, it is inserted with a membranous Tendon into the first ioynt of the thumbe which it leadeth from the foure-fingers. This muscle with the second and third benders of the thumb maketh that fleshy portion of the palme which is at the roote of the thumbe, wee commonly call it the brawne of the hand.

The third originall. Insertion. Vse.

The fourth *extender* [Tab.24,fig.1,2,3,4,[z]·] occupies the space which is betwixt the the thumbe and the fore-finger. It ariseth fleshy, partly also sinewy from the inner and backer part of the bone of the After-wrest which lies vnder the fore-finger, and is fleshily inserted on the whole outside into the first ioynt of the thumbe. Moreouer it transmitteth a membranous Tendon to the second, which *Fallopius* in his *Institutions* acknowledgeth he hath found, but in his obseruations he saith he could neuer meete with it. This muscle serueth for the laterall motions of the thumbe. It leadeth it also to, and layeth it vppon the fore-finger. And so much for the muscles of the thumbe as wel *benders* as *extenders*. Now we proceede to the muscles of the After-wrest and wrest.

The fourth originall. Insertion. His vse.

CHAP. XXXII. *Of the Muscles of the After-wrest and the wrest.*

THE After-wrest called *Metacarpium* or *Postbrachiale*, is a part of the hand seated betweene the wrest and the fingers. It hath eight muscles, for in euery distance betwixt bone and bone, there are two muscles which are fastened to the sides of the bones and therefore are called *interossei*. Those that arise from the bones to which they grow, are throughout fleshy and run directly according to the length of the bones, creepe on the backsides of their fingers, and their tendons are mixed with the tendons of the foure first exending muscles of the fingers which we called the VVorme-muscles. Sometime this mixture is made before their Insertion, so that the wormy and bone-bound Muscles do seene to make but one broad tendon.

The After-wrest.

The muscles called *interossei*, that is, *bone-bound*. Their originall. Vnion with the woormy muscles.

They are a little gathered or bound together by the Ligament of the first ioynt, and run by the sides to the outward tendons of the fift muscle that extendeth the fingers, into which also they are inserted and with them are the authors of the extension of the second and third ioynt of all the Fingers; and because they cleaue to the sides of the fingers, it should seeme they were ordained to part the fingers asunder, and to leade them againe together.

Insertion. Vse.

Hence it is, that if a man be wounded on the outside of the After-wrist, he looseth the motion of the first ioynts of the fingers, because the muscle which extendeth the finger is cut asunder, yet the second and third ioynts are strongly and quickly extended because these small muscles do remaine sound. These muscles doe make the inward cauitie in the After-wrist so plaine and equall (like as others do the same in the foote) that the particular

A note for Surgeons.

cular tendons of theſe muſcles may run directly to the performance of their offices vpon a ſmooth and ſoft bed. They are alſo by this meanes ſecured from the offence which they could not otherwiſe but receiue by the hardneſſe of the bones vnder them. Finally, they do not ſuffer thoſe muſcles, together with the fat placed aboue them, to bee exiccated or dryed but maintaine and cheriſh their moyſture.

The muſcles of the wreſt.

The next part of the Hand is the wriſt called *Carpus* or *Brachiale*, and is in the midſt betwixt the Cubit and the After-wriſt. The motions of the wriſt are to be bent, to be extended and to be enclined to eyther ſide, wherewith alſo the reſt of the hand is mooued with one and the ſame motion, and all this is performed by the helpe of foure Muſcles; whereof two ſeated within do bend, and two extend which are ſeated without.

The firſt bender.

The firſt bender which is alſo the lower, [tab. 22. f. 1, 3, ◁ and tab. 23. f. 1, & tab. 24. f. 1, and 2 ◁] ariſeth with an acute originall mixed of a fleſhy and neruous ſubſtance from the inner or lower protuberation of the arme, and being fleſhy ſtrengthneth himſelfe by adhering vnto the length of the Ell euen vnto the wriſte, and for retribution ſerueth the bone for a pillow, which vſe we eſpecially make of it when wee write, for then wee leane vpon this muſcle. Preſently after, that is to ſay at the very wriſt, it degenerateth into a fleſhy and neruous tendon which is implanted into the fourth bone of the wriſt called by *Galen Os Cartilagineſum*, and to the Ligaments of that ioynt it is connected and compaſſed about with a common Membrane. [ν is his beginning and ϰ his inſertion]

The ſecond bender.

The ſecond Bender or the vpper [tab. 22 f. 1 and 2, and tab. 23 f. 1 and ○] ariſeth from the ſame protuberation and deſcendeth obliquely after the length of the wand, but before it come to the roote of the wriſt it endeth in a ſtrong tendon which hauing ouer-paſte the inſide of the wriſt becommeth broader and is inſerted into the roote of the bone of the After-wriſt which ſuſtaineth the forefinger. It groweth alſo vnto the tranſuerſe Ligament.

The vſe of the two Benders.

Theſe two Muſcles if they worke together do bend the Wriſt forward, and ſecondarily the hand alſo: but when one of them onely worketh it moueth obliquely now vpward now downward that part of the wriſt into which it is infixed, yet it giueth ſomeayde to the two Muſcles which are ſeated without.

The firſt Extender.

The firſt Extender or the lower [Tab. 22. f. 4. and tab. 24. f. 1 & 2 ϰ] ſeated betwixte the firſt muſcle of the wriſt, and the fift extender of the Fingers, taketh his original aſwell from the roote of the externall or vpper protuberation of the arme, as alſo from the top of the cubite which it embraceth and runneth through his length, and when it attaineth to the wriſt, it is infixed with a round, neruous and ſtrong tendon aboue the appendix of the Cubite into the bone of the After-wriſt which lyeth vnder the little Finger, and not farre from the VVriſt. Sometimes alſo before his Inſertion, it hath a Seed-bone growing to it.

The ſecond Extender.

The ſecond Extender or the vpper which is alſo called *Bicornis* or the two-horned Muſcle [tab. 22, f. 2, 4, ≤ and tab. 21 f. 2, 3, ≡] ariſeth fleſhy with a broade beginning from the bony edge which is in the arme aboue the exterior protuberation [ta. 24 f. 3 ϒ]. It runneth vpon the wand and aloue the middeſt of it determineth into a thicke, ſtrong, and double horned tendon, vhence it hath his name ſaith *Columbus* and *Archangelus*, and when it hath directly ridden ouer the wriſt, the one of them is inſerted into the firſt bone of the After-wriſt, which ſuſtaineth the fore finger and into the extremity or ende of the VVand: the other is infixed into the ſecond bone of the After-wriſt, vppon which the middle finger leaneth. *Archangelus* ſaith that he hath often found this two-horned muſcle double, that is to ſay, wo muſcles; one greater whoſe originall was neruous, & whoſe tendon ended below the ioynt of the arme into foure fingers. The other leſſe, whoſe originall was neruous alſo but his tendon ended in the middeſt of the VVand. He addeth alſo that his tendons are firſt broade, afterward round.

The vſe of the 2. extenders.

Theſe two extending muſcles if they worke together, do bend the wriſt outward & extend it primarily, ſecondarily alſo the hand; and are holpen by a portion of the thirde muſcle which extendeth the thumbe. Secondarily alſo they leade the wriſt about when one in his motion immediately followeth another. But when one of them onely worketh, then diuers motions are produced: for if eyther they worke aſunder, or one of the benders worke togethe with an extender, it moueth the wriſt obliquely and to the ſide. And thus much of the muſcles of the After-wriſt and the wriſt, now we proceed vnto the muſcles of the Cheſt.

CHAP.

CHAP. XXXIII. *Of the Muscles of Respiration.*

THE Chest contayneth the Instruments or Organs of life: Life cannot bee maintayned without Respiration, neither can Respiration bee perfomed without motion; it followeth therefore that the Chest must needs be moued for Respiration sake. If it be demanded why Respiration is so necessary, we answere, because of the high and great heat of the Heart, which by the ayre attracted in Respiration is refrigerated and cooled, euen as a mans face in Summer is cooled by a fan that wasteth fresh ayre vnto it. Whythe chest moueth.

Now the Chest is moued either by it selfe or by accident when it followeth the motion of the spine or Rackbones of the backe, for when the backe is bent the Chest is also bent with it.

It is moued by it selfe and with a proper and peculiar motion for Respiration sake, which Respiration is accomplished by a double motion of the Chest: which is dilated when Inspiration is made, that is, when we draw the ayre into our Longues and so coole the heat of our Hearts; or contracted in Expiration, that is, when the ayre is driuen back through the Rough artery for the generation of the voyce, and the sooty excrements are blowne away least the heart should be suffocaced by them. His different motions.

In these motions of the chest wee must consider notwithstanding, that in Inspiration the lower parts of the chest are dilated and the vpper angustated or straytned: on the contrary in Expiration the lower are constringed or straytned, the vpper dilated. And this was the reason why the Chest was not made of one bone as was the Scull, but of many, which also are ioyned together by gristles that their motion might be more pliant and easie. Why not bony.

But as the heart is moued with Naturall motion, so the Chest is moued partly with Naturall partly with Voluntary motion: with Natural; because in our sleepe it is moued Naturally not according to our Will. VVith Voluntary, for wee haue read of some that by reteining their breath haue hastned death vpon themselues. As for the Longues they follow the motion of the Chest especially to auoyde vacuity, as well in those that sleepe as in those that are awake. The kinde of motion.

Philosophers doe differ much concerning these motions, but because we haue already touched vppon their disputation in the tenth question of the sixt Booke, wee will not here Tautoligize though haply we might say something now, because this Volume groweth far beyond that extent which was first limitted for it.

The Chest therefore needed Muscles for Respiration, Respiration is absolued by his Diastole or dilatation when we breath in, & by his *Systole* or contraction when we breath out. How respiration is made

These Muscles are in all 65. on each side 32. that is to say, 22. *Intercostal* Muscles, 11. internall and as many externall, and one which is common to both sides called *septum transuersum* or the Midriffe. Of these we haue spoken before in the fourth and fift Chapters of the sixt Booke. The number of the muscles of respiration.

There remaine yet the proper Muscles of the Chest, sixe on either side, vnlesse it please you to adde three more according to *Falopius*: Finally, the Muscles of the *Abdomen* (which helpe also our Respiration) are on each side foure beside the *Pyramidals* or Spirie Muscles, so that the whole summe will now amount to 71.

Of these some are Common, as the Muscles of the *Abdomen* which beside Respiration doe serue also for other purposes, others are Proper and serue for Respiration alone. But Respiration is double, one free or naturall, the other constrayned or violent. 2. kinds of respiration.

That we call Free which is done gently and easily, that is, when in Inspiration there is without constraint so much ayre drawne in as may suffice for the generation of vitall spyrits, and in Expiration when a part of the attracted ayre is againe gently returned for the generation of the voyce, and both these are wrought by the motion of the Midriffe alone. Free.

The first by the Contraction of the Midriffe wherein the end of the bastard ribs are gathered a little vpward, the lower and forward part of the Chest angustated or straitned and the backepart inlarged to the Racke-bones, the seauen lower ribbes parted as it were asunder and so the Chest dilated.

The second, when the Midriffe is relaxed or loosened, for then the Chest doeth easily fall with his owne waight. We call that Respiration constrained, when the Dilatation Violent.

or contraction of the cheſt is euident, that is, when in Inſpiration the breath is drawne with violence or vehemencie, as it happeneth when the heart is too much heated: and in Expiration when the ayre is forcibly blowne out, as when wee would ſpeake or hallow aloude, when we would cough or ſneeſe, or elſe when vpon expulſion it is retained when we would make vſe of the midrife in euacuation of excrements or ſuch like.

How the muſcles moue.

This reſpiration is abſolued by ſixtie foure muſcles aſſiſted by the midriffe, yet ſo that in Inſpiration fewer muſcles do labour them in Expiration. In Inſpiration, that which is called *Subclauius*, *Serratus maior*, *Serratus poſticus ſuperior & inferior*, and *Falopius* his 3. muſcles. The Intercoſtall muſcles doe alſo conferre to this buſineſſe, but that by accident onely. In Expiration more muſcles are required, becauſe we breath out with greater ſtrength then we breathe in; theſe are called *Sacrolumbius*, *triangularis*, and all the Intercoſtalls; for the exteriour doe leade the lower ribs vpward, and the interior the vpward ribs downeward. The eight muſcles of the *Abdomen*, and haply in great neceſſities the muſcles of the arm and the ſhoulder blades do lend their helping hands. The Intercoſtal muſcles we wil here altogether paſſe ouer, as alſo the midriff, becauſe we haue ſpoken of them at large before. The muſcles of the *Abdomen* we referre vnto the next chapter, here we will onely handle the proper muſcles of the cheſt, which grow thereto. Theſe are accounted by *Galen* eight, and ſo many they are indeed in Apes, but in men there are but ſixe in either ſide commonly receiued, to which *Falopius* addes three.

The poſition of the muſcles.

Two of theſe muſcles are ſeated before, the one called *Subclauius*, the other *Triangularis*, one occupieth the ſides called *Serratus maior*, the reſt lie vpon the back part, three in the backe, two called *Serrati poſtici*, and the third *Sacrolumbus*; three in the necke, and

Tab. 2. Sheweth the muſcles eſpecially of the cheſt, the head, and of the ſhoulder blade.

TABVLA XXV.

A, The fourth muſcle of the Cheſt, or the vpper & hinder Saw-muſcle.

B, the 5 muſcle of the cheſt or the lower and hinder Saw muſcle.

a,*b*, A membranous beginning of the muſcle of the *Abdomen*, deſcending obliquely downe from the ſpine of the backe.

C, the 1 muſcle extending the Cubit at *c* his originall is from the necke of the arme, and from the lower baſis of the blade at *d*.

E, the originall of the fourth muſcle of the Bone *hyois* from the blade.

G,G, the outward intercoſtal muſcles.

I. the Clauicle or Collerbone bared.

N the vpper, the 2 muſcle of the arme cald *Deltoïs* Char, 4, 5, the beginning of this muſcle.

N, the third muſcle of the arme or the broad muſcle ſeparated.

O, the fourth muſcle of the arme or the lower *Super Scapularis* or bladerider.

1, 2, 3 char: His originall at the baſis of the ſhoulderblade at 12 and his inſertion into the ioynt of the arme at 3.

Q, the ſixt muſcle of the arme or the vpper *Super-Scapularis*.

X, The fourth muſcle of the blade called *Leuator* or the heauer.

Z, The ſecond muſcle of the cheſt or the greater ſawe muſcle.

7.7. Char. The ribs.

Γ, The ſixt muſcle of the cheſt, or the muſcle caled *Sacrolumbus*.

Λ, The firſt muſcle of the head or the ſplinter.

ΕΕ, the ſecond muſcle of the head or the inſertion of the muſcles called *complexi*.

Φ, The 2. muſcle of the back or the longeſt muſcle

Ω, The fourth muſcle of the backe called *Semi-ſpinatus*.

theſe are they which we ſaid before were propounded by *Fallopius*. But by *Veſalius* are eſteemed to be parts of thoſe muſcles which occupy the necke and the back, but we come to the particulars.

The firſt proper muſcle of the cheſt is called *Subclauius*. [tab. 17, [Y]. tab. 22, fig. 3, [Y]. The reaſon of the name is, becauſe it is ſeated vnder the coller-bone which is called *Clauicula*, for it filleth that ſpace which is betwixt the clauickle and the firſt rib. 1. ſubclauius.

This muſcle ariſeth fleſhy from the inner and lower part of the clauickle which is next to the rib, runneth obliquely forward, and is fleſhily implanted into the vpper part of the firſt rib which is ioyned to the breſt bone. His fibres are very oblique, yea almoſt tranſuerſe. The vſe of it is to draw the firſt rib vpward and outward, and ſo the cauity of the cheſt is dilated.

The ſecond muſcle is called *Serratus maior* or the greater ſaw-muſcle. [tab. 10, 17, 25, [Z].] It is a large muſcle, ſituated in the ſide of the cheſt, broade alſo and euery way fleſhy. His originall is large and fleſhy from all the inner baſis of the blade, and towards the ribs it is dilated, coucheth vpon them, is tyed to the by fibres, and is inſerted as it were diuided into fingers into the eight vpper, ſometimes alſo into the ninth rib, before they do determine into their griſtles. And theſe inſertions of thes muſcles are acute or ſharp becauſe of the tendons which deſcend obliquely with points like the teeth of a Saw, to meet with the teeth of the oblique deſcendent muſcles of *Abdomen*, with which they are finger-fanged as alſo is the lower and backeward Saw. 2 Serratus maior.

The vſe of this muſcle is by the collection of his fibres in great and violent conſtraintes or endeuours to draw the eight ribbes outward, and ſo to dilate the cheſt. But in dogs and Apes it is not onely inſerted into the eight ribs, but implanted alſo in the tranſuerſe proceſſes of the fourth, fifth, ſixt and ſeauenth rackbones of the necke, or if you pleaſe it ariſeth therefrom.

The third proper muſcle of the cheſt is called *Serratus poſticus ſuperior* [tab. 25, [A]] the vpper *backe-ſaw*. It lyeth in the backe vnder the muſcle called *Rhomboides* or the thirde muſcle of the blade, betwixt both the blades and aboue the firſt muſcle of the head. A little muſcle it is, and ariſeth broade and membranous from the ſpines of the three lower rack-bones of the necke and the firſt of the cheſt. Afterward it paſſeth a little obliquely vnder the blade, becommeth fleſhy, and being diuided into three parts is inſerted into the three diſtances of the foure vpper ribs. 3. Serratus poſticus ſup.

The vſe of it is to draw the ribs vpward, to which it is implanted by contracting his fibres, and ſo the cheſt is dilated and the hinder cauity thereof inlarged.

The fourth is called *ſerratus poſticus inferior*, the lower *backe-ſaw* [tab. 25, [B]] and ſeated almoſt in the middle of the backe vnder the broade muſcle that is the third muſcle of the arme. It ariſeth membranous, neruous, broade and almoſt quadrangular like a combe as the other, but broader then it from the ſpines of the two lower rack-bones of the cheſt, ſometimes of the three, ſometimes alſo from the vpper rackes of the loynes. Afterward it paſſeth ouerthwart and lyeth vpon the muſcles of the backe, and beeing increaſed with fleſhy fibres is inſerted at the diſtances of the foure lower ribs before they determine into griſtles. The inſertion is made into the ribs themſelues, and the muſcle at the inſertion diuided as it were into fingers. It is much broader in men then in apes and dogs and in dogs larger then in apes. 4. Serratus poſti. infer.

The vſe of this muſcle is to draw the three or foure lower ribs outward, and ſo doth dilate the lower part of the cheſt as we ſaide the ſecond muſcle did dilate the vpper part.

The fift muſcle is called *Sacrolumbus* [Tab. 10, [Γ]] ſayeth *Laurentius* it ariſeth from the *Oſſ ſacrum* and the ſpines of the *Lumbi* or loynes. This muſcle may be thought to be common as well to the cheſt as to the backe. It lyeth vnder the former, and ariſeth fleſhy from the backe part of the *holy-bone*, and the vpper and inner part of the haunch bone. Afterward it creepeth vpward faſtening it ſelfe to the tranſuerſe proceſſes of the rackes of the loynes, and as farre as to the lower racke of the cheſt, is mixed with the long muſcle of the backe, [tab. 10, at φ] ſo that a skilfull hand can very hardly ſeparate them, and therſore it is eſteemed but a portion thereof. [tab. 10, α, β.] A little aboue the lower rack-bone of the cheſt it departeth from the other muſcles to which it did grow, and becomming by degrees more ſlender, is inſerted obliquely with round tendons not altogether fleſhy produced from the outward ſide [ta. 10, [YY].] into ſixe protuberations of the lower ribs which are their rootes. From thence as *Fallopius* rightly obſerued, are produced ſixe new fleſhy 5. Sacrolumbus.

Fallopius his 6. new muſcles.

muſcles neruous both in their originall and inſertion, and are implanted into the ſixe vpper ribs: ſo that from the twelfth rib where this muſcle is inſerted there ariſeth a certaine tendon, which becomming fleſhy and climing vpward looſeth his fleſh againe and is infixed into the ſixt rib, carrying the reſemblance of a ſlender muſcle. In like manner from the eleuenth rib proceedeth another Tendon which is inſerted into the fift rib, and one alſo from the tenth which is inſerted into the fourth, one from the ninth into the third; finally, from the eight and the ſeauenth which are implanted into the firſt ribs.

All theſe Tendons doe reſemble diſtinct Muſcles, yet they are ſo commixed together and with the *Sacrolumbus* in the ſurface that they ſeeme to bee partes thereof whereas indeed they are not, ſo ſayth *Falopius* in his obſeruations. VVherefore when as the *Sacrolumbus* draweth the ſixe inferior ribs backward and therewith downward, it moueth alſo together with them the ſixe vpper foreſayde additaments which are called *anſulæ* or the handles, and ſo conſtringeth the Cheſt.

The 6. proper muſcle.

The ſixt proper Muſcle of the Cheſt hath his name from the forme and is called *Triangularis* or the triangular Muſcle, becauſe it conſiſteth of two long ſides & one ſhort. It is ſeated within the cauity of the Cheſt vnder the breaſt-bone: little it is and ſlender, & in ſome men eſpecially if they bee leane, there appeareth nothing fleſhy in it. In ſome parts it is like a neruous Membrane ſtuffed with fleſh.

His originall.

It ariſeth from the lower part of the Breaſt-bone and paſſeth obliquely vpward and outward, growing to the griſtles of the true ribs euen vnto the ſecond: and this is the reaſon why the *Intercoſtall* Muſcles and thoſe which are called *Intercartilaginei*, that is, betwixt the griſtles doe appeare diuers, becauſe of their diuers fibres. The vſe of this muſcle is to leade the griſtles of the ribs together, and ſo to conſtringe the Cheſt or to preſſe down the forepart therof ſo much as is neceſſary for Reſpiration, but in Dogs it is wholly fleſhy and occupyeth the whole ſide of the Breaſt-bone.

Falopius his 3. muſcles.

Falopius is of opinion that the firſt and third Muſcle are too weake to ſuffice for the eleuation of the Cheſt, for hee eſteemeth the ſecond rather to bee a mouer of the blade; and therefore he ſayth that there are three other muſcles which performe this office placed in the necke, which *Veſſalius* in his Apology accounteth for partes of theſe Muſcles which occupy the necke and the backe.

The firſt of theſe three ariſeth with a neruous beginning from the inſide of the tranſuerſe proceſſes of the 3.4.5. and ſixt Racke-bones of the necke; then becomming more fleſhy it is infixed into the firſt ribbe which it lifteth vp, and together with it the whole Cheſt.

The ſecond is called *Scalenus*, becauſe his figure is vnequally triangular, [Ta.29.λ Table 13.CC.] It ariſeth fleſhy from the tranſuerſe proceſſes of all the racke-bones of the neck, the firſt and the ſecond being ſometimes excepted, and hath a fleſhy inſertion into the firſt rib, ſometimes alſo into the ſecond. This alſo ſerues to lift vp the cheſt.

The third and laſt ariſeth from the tranſuerſe proceſſes of the fourth and fifth racks of the necke, and is implanted with a fleſhy termination into the ſecond ribbe ſometimes into the third, and lifteth vp the rib into which it is implanted.

By theſe three Muſcles therefore and the *vpper back ſaw*, *Falopius* conceiueth that the cheſt is eleuated. And thus much ſhall ſuffice to haue ſayde concerning the muſcles of cheſt. Now follow the Muſcles of the *Abdomen*.

CHAP. XXXIIII. *Of the Muſcles of the Abdomen or Paunch.*

The order of the muſcles of the *Abdomen*.

THere bee tenne Muſcles which couer the nether Belly, on either ſide fiue called the Muſcles of the *Abdomen* which are placed in this order. Firſt do appeare two obliquely or ſidelong Deſcending and as many Aſcending, which haply may more rightly bee diſtinguiſhed if they bee called the oblique externall and oblique internall, for they all aſcend or deſcend equally as a mans eye pleaſe. Next two Pyramidall, after them two Right Muſcles, and laſt of all two Tranſuerſe or ouerthwart, ſo called according to the leading of the fibres which doe mutually deuide themſelues, as *rightly* ſo *obliquely* and *ſidelong*.

The oblique or ſidelong deſcending, or oblique externall Muſcles [Tab.26.A B] ſo called of their oblique fibres [Ta.26.H] are placed in the ſides: they are of a Triangle Figure, and amongſt all the Muſcles of the *Abdomen* the greateſt and the broadeſt. Theſe where they are more fleſhy proceede from the top of the haunch-bone, [Table 26.f] and from

from thence haue their strength and firmenesse; more neruous they proceede from the share-bone [Ta.26.ᵍ] where they are perforated, and membranous from the membrane springing out of the Ligaments of the spondels or racke-bones of the loynes: and so rise vpward and ending somewhat fleshily do cleaue to seauen, sometimes to eight of the lower ribs before they determine or end into their gristles. Their situatiō

That they doe arise from below it is manifest, because by all mens consent they serue to dilate the Breast and so helpe Inspiration; and therefore they must end in the Breast and not arise thence from, because it is a ruled Axiom that euery Muscle draweth toward his owne originall not toward his insertion. They are therefore inserted into the great Saw-muscle [Tab.26.ᵉᵉ Ta.27.ᵖ Ta.28.ᵒᵒᵒ] at the 6.7.8. and 9. ribs as it were with [Ta.26.ᵇᵇ] a Finger-fould, as also into the lower backe-Saw at the three lowest ribbes: sometimes they are ioyned to the Pectorall muscle with a thin neruous Tendon. Forward they [Ta.26.ᶜᶜ] are carried with a broad neruous and membranous Tendon, and in the middle of the *Abdomen* doe so mingle themselues at the white Line [Ta.26.ᵈᵈᵈ] that they make as it were a coate which spreadeth ouer all the *Abdomen*. These Muscles are ioyned also to those vnder them by the interposition of a slimy substance like fast glew:

This white Line [Tab.26.ᵈᵈᵈ. Ta.27.ᵉᵉ Ta.28.ᶻᶻ] is in the middle of the *abdomen*, bred out of the concourse or meeting of all the Tendons of these muscles except the *right*. For the Tendons of the oblique muscles are so closely vnited, that it seemeth but one tendon, and the Tendons of the inferior oblique do grow to the tendons of the transuerse where the right Muscles doe separate themselues, and so meete in one line, into which also the Pyramidall or spiry Muscles are implanted. The white line.

This Line beginning at the Sword-like Cartilage or the Brest-blade neruous, passeth vnto the commissure or ioyning together of the share-bones: aboue the Nauell it spreadeth it selfe broader, but below it is narrower and is therfore white, because there is no flesh or red foyle vnder it. It serueth to hould together all the Muscles as in a common end or termination, that so the right Muscles might remaine in the right side and the left in the left, and neither bee hialled ouer his limits. It hath also sometimes Fatte lying vpon it. The vse.

The oblique ascendent [Tab.26.ᵖ Ta.27.i reflected from the *abdomen*] or oblique internall muscles which doe intersect the former with their oblique ascendent fibres like S. Andrewes Crosse, or in the manner of the Greeke Letter χ [Table 26.ᶦᶦ] doe occupy the middle part of the *abdomen*, and are of a Triangular Figure. They arise fleshy from the appendixe of the haunch-bone, and membranous from the membrane before named, & the spines of the Holy-bone, and being increased with fleshy fibres and couering the hanches doe ascend vpward, and becomming fleshy are knit vnto the gristles of the foure lower ribbes, and so are brought to the forepart of the *abdomen*, and end in a broad neruous and membranous Tendon: which when it meeteth with the right [Tab. 27.ʰ] Muscles is diuided into two tendons, one of which passeth aboue the *right Muscle*, the other creepeth vnder it (for which cause *Galen* writeth that the right muscles are not couered with any externall muscle, meaning there by muscle flesh, for that that couers them is indeede but a Tendon:) so that by this imbracement the length of the right Muscles is fortified and kept safe from solution or breaking, and as it were hemmed in the middest of three muscles; where they do not as before couer the muscle after the manner of a membrane, but doe so adhere to the intersections and partitions of the right Muscles, that their tendon can be very hardly seuered from them. The oblique internall. Their original Their tendōs.

Being passed the right Muscles, they againe mingle themselues, are firmely and closly knit and vnited, and so goe hence away to the white Line [Ta.27.ᵉᵉ] framing as it were another membrane, and aboue doe meete with the sword-like Cartilage or Gristle of the Chest. Below they meete a little vnder the Nauel, but the vpper Tendon is inserted into the share-bones.

These foure Muscles haue Veines and Arteries from the *Muscle-veine* and Artery, springing about the Loynes which are disseminated through all the region of the *Abdomen* and the *Peritoneum* or Rimme of the Belly: they receiue nerues also from the last spondels or racke bones of the Chest, which are inserted according as the leadings of the fibres are. Their vessels.

The proper vse of the externall oblique Muscles is, when they worke together obliquely, to compresse the vpper and side parts of the lower belly on either side, and of the

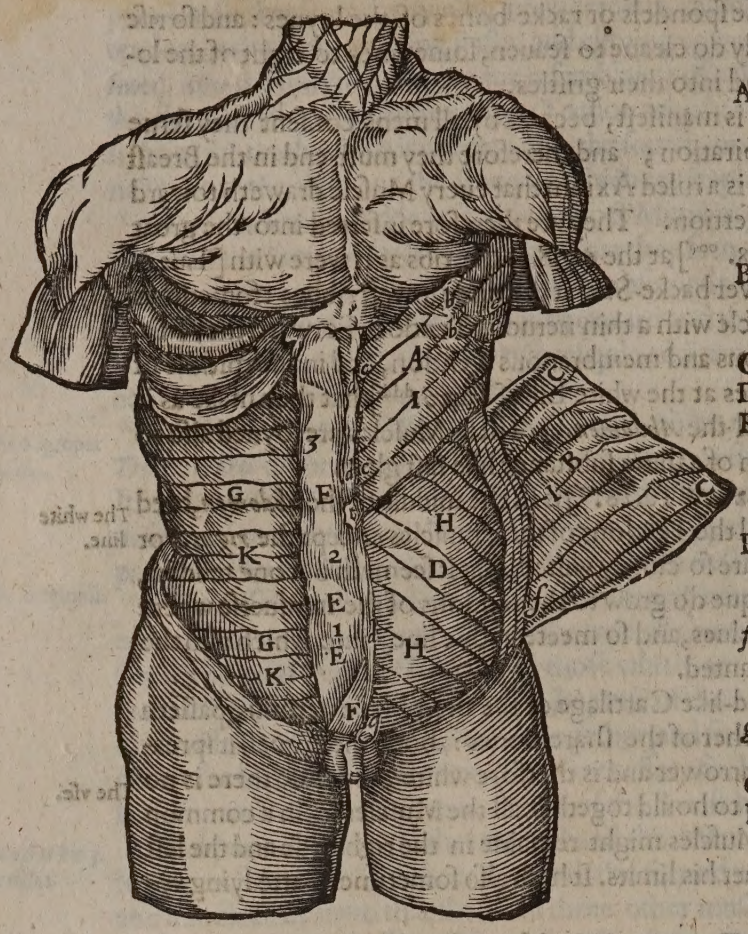


Table 26. Sheweth all the muſcles of the lower belly, on the left ſide the oblique muſcles, and on the right ſide the Piramidall, the right and the tranſuerſe.

TABVLA. XXVI.

A, The vpper part of the oblique externall or deſcending muſcle not ſeparated, wherein his connexion at *b b*, with the Saw-muſcle at *e e*, is declared, and his implantation at C C into the white line at *d d*.

B B, The lower part of the oblique deſcending muſcle ſeparated from the white line at *d*.

C C, His tendon.

D, The oblique deſcending muſcle.

E E, the right muſcle on the right ſide, from which both the oblique muſcles are remoued, 1,2,3. The interſections of the right muſcles.

F, the *Piramidal* muſcle on the right hād, for both the left & the right pyramidal muſcles are vnder the oblique.

f, The fleſhy originall of the oblique externall muſcles from the haunch bone.

g, Their beginning from the ſhare-bone as alſo the *Piramidall* muſcles original.

G G, The tranſuerſe muſcle.

H H, The fibres of the oblique aſcending muſcle.

I, The fibres of the oblique deſcending muſcle that ſo the decuſſation may appeare.

K K, The fibres of the tranſuerſe muſcle.

oblique Internall in like manner to compreſſe the lower and ſide parts: but wee muſt not conceiue that all the lower belly is by theſe muſcles compreſſed, becauſe their Tendons reach but a little below the Nauill. The compreſsion is therefore made on either ſide but to the top of the groyne, for they are inſerted into the griſtly and moouable partes of the Ribbes.

°The Pyramidal muſcles.

The Pyramidall Muſcles, ſo called from their forme like a Pyramis or Broch, ariſing from the outſide of the ſharebone [Ta.26.F Ta.27,g] with a fleſhy and narrow beginning ſiding together like two parts of a ſpire, (for they are ſeldome ſo vnited that they make but one muſcle) doe clime with oblique fibres ouer the heads of the right muſcles from whom they are diſtinguiſhed by a peculiar membrane and different fibres; and do end in the white line (neuer in the right muſcles) with an acute tendon of their owne, but one longer then another; neyther in length exceeding the breadth of foure fingers: but theſe though they be moſt commonly ſeene in diſſections, yet in many bodies they are wanting, although *Fallopius* neuer diſſected body but he found them.

They are oftē wanting.

The vſe of theſe ſpiry muſcles is to compreſſe the bladder, for if one of them work alone, it draweth the white line obliquely downeward. If they worke together, they draw it directly downeward, and ſo compreſſe a part of the groine and the bladder therevnder, when we make water at leyſure. For if wee force our water with any violence, then the other muſcles of the *Abdomen* doe alſo helpe, preſsing the whole paunch & with it the bladder. And if we marke our ſelues in ſuch ſtrainings we ſhall manifeſtly perceiue that the *Abdomen* is contracted downeward; and hence it is that they are alſo called *Succenturiati* the aſsiſtant muſcles becauſe they helpe all the reſt.

The vſe of the ſpiry muſcles.

And if at any time (as it happeneth but ſeldome) theſe pyramidall muſcles bee wanting, then the oblique aſcendents doe not take their firſt originall from the appendix of the haunch-bone, but lower from a ſtrong ligament which runneth from the aforeſaid appendix vnto the ſhare-bone, and then they vrge obliquely downeward what ſoeuer is vnder

der the groyne as is the bladder of vrine. They also adde strength to the heads of the right muscles to which also they serue as a defence. Whereuppon some haue imagined them (though fasly) to be another originall of the right muscles. For if wee gently auoide our vrine neyther the inspiration nor expiration is interrupted, which it certainely would be if they were parts of the right muscles, becausse when the right muscles are contracted, the chest also is compressed, whence it would follow that when by the contraction of these muscles we would exclude our vrine, we cannot draw in breath till wee remit or loosen the intention of the muscles.

The Right muscles [Tab. 26, [aa] Tab. 27, [a] Tab. 28, they hang downe and are marked with [a]] haue their name both from their right fibres, and because they are placed according to the straight length of the body: they are situated vnder the neruous thinnesse of the oblique, and in some places ioyned vnto them: they occupy the higher place, whereupon their tumors being longer then round, may easily be distinguished from the tumors of other parts by their position. Their originall is neruous from the fore and vpper [Tab. 27, *bb*, Tab. 28, charact. [a a]] part of the share-bone, (not from the brest because the bones of the share, hips and haunches are not moued) but presently they become more fleshie, and climing ouer the belly about the nauill do seeme as it were to bee vnited [Tab. 27, [f]] which yet is but the vicinity of their originall: but by how much they ascend higher by so much are they more seuered [Tab. 27, [c c]] and grow broader, and doe at length grow to the Cartilages or grissles of the lowest true ribs at the sides of the brest-bone with a fleshy and ample insertion. [Tab. 27, [c c]] They are fleshy and strong the better to compresse the foreside of the *Abdomen*, and haue three seldome foure intersections or partitions very neruous and transuerse or ouerthwart [Tab. 26, charact. 1, 2, 3, Tab. 27, [d d d]] as it were hanked or knotted asunder, so that they seeme to be not one, but many paire of right muscles, diuided and distinguished by the tendring or oblique bending of their fibres to these surfled intersections.

The right muscles.

Their tumors how knowne.

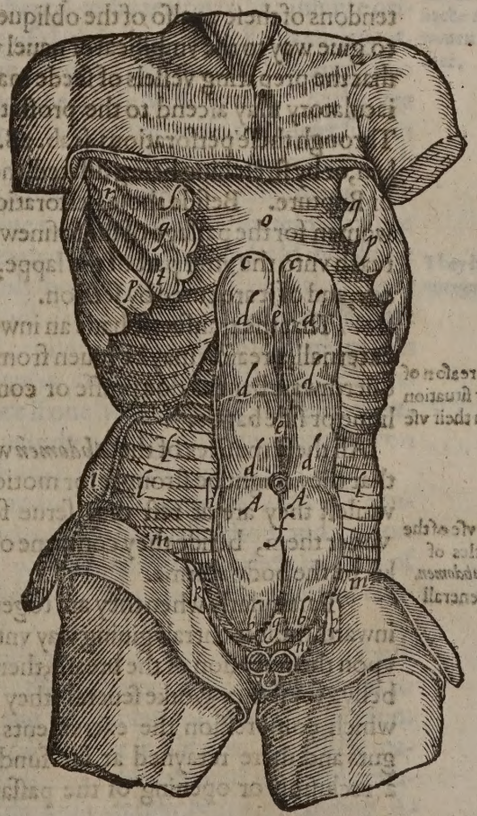
Their originall and insertion.

Their intersections.

These intersections are firme and solid membranes, whereof one is vnder the Nauill, two and sometimes three aboue it; all which are ordained eyther to strengthen the muscle which is appointed for especiall hard imployment, particularly in deepe expirations; or else that being obliquated or *shewed* after the round figure of the *Abdomen* and fastened with the tendons of the oblique ascendents they might more closely presse the *Peritonæū*.

Table 27. Sheweth the Right, the Transuerse, and the Pyramidall Muscles.

TABVLA. XXVII.



A A, The right muscles of the *Abdomen*.
bb, Their neruous originall.
c c, their implantation.
d d d d d, their intersections.
e e, the white line where the right muscles doe depart one from another.
f, the coniunction of the right muscles vnder the Nauill.
g, The *Piramidall* muscles.
h, the membrane of the oblique ascending muscle which cleaueth fast vnto the tendon of the trāsuerse muscle & so attaineth vnto the right muscle.
i, the oblique ascending muscle here reflected from the *Abdomen*.
k k, the production of the *Peritonæum* or rim of the belly with the seede-vessels.
l l l, the transuerse muscles:
m, the groynes.
n, the circles which shew the bodies of the yard cut away.
o, the share-bone without flesh.
p p, the greater Saw-muscle.
q, the lesser Saw-muscle.
r, s, t, His amplitude and fastening to the ribs.

They

um. They haue veines which we call *Recurrents*, and arteries from the *Epigaſtricke* [tab.28. [11]·fig.2.[b]](from which alſo branches are ſent to the neck of the womb)diuided into many ſurcles or tendrils for their nouriſhment and life. VVhich being led vpward vnder their bodyes are about the nauell,[tab.28.fig.2.[c c]·] ioyned with the internall mãmary or pap [tab.28.fig.[x x]. fig.[a]·]veynes (which deſcend vnder the breſt bone) by *Anaſtomoſis*, that is, inoculation of their extremities.

Anaſtomoſis what it is. VVhich *Anaſtomoſis* or kinde of vnion is the reaſon of the great conſent betweene the wombe and the paps, the *Abdomen* and the noſthrils. This conſent of the wombe with the paps, is alſo increaſed by certaine internal veins, one called the *Axillarie* which goeth vnto the paps, and by the branches of the *Hypogaſtricall*, which are diſtributed vnto the wombe. [*Tab.28. is the ſame with Tab.5. in the 2. Booke, fol.78.*]

The vſe of the right muſcle. They haue ſometimes foure nerues moſt what proceeding out of the middeſt of the laſt ſpondels or rackbones of the cheſt and ſo reaching to their hanked or ſurfled interſections or diſtinctions. Their proper vſe is to driue the higheſt and middle part of the lower belly not downeward but directly to the ſpine, to compreſſe it and to preſſe downe the lower parts of the cheſt by drawing them directly downeward. They helpe vs alſo in violent Expirations.

The tranſuers muſcles. The tranſuerſe or ouerthwart muſcle, [Tab.26.[o o]. tab.27.[111]· and tab.28.[M]· a part of it is reflected,]is placed ouerthwart the belly, and ſo named from the tranſuerſe [tab.26. [x x]·] fibres which run through the bredth of their bodyes. Theſe are vndermoſt and doe ariſe neruous from the inward endes of the baſtard ribs, and the membrane twice before ſpoken of, and are inſerted, being become more fleſhy to the hanch bones, [Tab.28.[N]· where the hanche bones is bared, at which the tranſuerſe and oblique muſcles do meete and are implanted,]which after they haue inueſted and attained to the vtmoſt ſides of the right muſcles toward the middle of the *Abdomen* they couer all the reſt of it with a brode neruous and membranous tendon like that of the oblique muſcle, and tend vpward to the ſwordlike cartilage or breſt blade, forward to the right line and downeward to the groyne, and doe ſo cloſely adhere or cleaue to the *peritonæum*, that in a man they can ſcarſe be cleanly ſeparated from it, but in the groyne this *Aponeuroſis* or brode tendon forſaketh the *peritonæum* or rime, and leaueth it bare.

Their veſſels they receiue like their oblique muſcles. Their proper vſe is to compresouerthwart the middle and laterall part of the lower belly, and eſpecially the collicke gut. The tendons of theſe as alſo of the oblique muſcles are perforated at the exiture of the nauell to giue way to the vmbilical or nauel veſſels, & again, on both ſides neare the ſhare bone, that the preparing veſſels of ſeede may deſcend through them to the teſticles, and the eiaculatory may aſcend to the proſtates which are annexed to the necke of the bladder. Through theſe perforations [tab.28.**.]the inward coate of the *peritonæum* being broken, or by ſtretching being dilated, the guts or the Kell ſlipping downe, cauſe the *Hernia* or Rupture. Beſide thoſe perforations common to both ſexes, they are alſo bored in women for the paſſage of thoſe ſinewy proceſſes which are called *Cremaſteres*, which doe reach vnto the vtter part of the lappe, whereupon women are troubled with the *Bubonocele*, and of it are cured by ſection.

The reaſon of their ſituation from their vſe That the tranſuerſe haue an inward ſituation, the right a middle, and the oblique an externall; a reaſon may be giuen from the Chyrurgicall deligations or ligatures, becauſe ouerthwart bandes doe preſſe or conſtraine more then right, and right more then oblique or ſide bands.

The vſe of the muſcles of the *Abdomen*. in generall All theſe muſcles of the *Abdomen* whoſe ſubſtance is partly membranous partly fleſhy that they might be ſtronger for motion haue this common vſe with other muſcles, that whileſt they are at reſt they ſerue for a muniment or defence vnto the parts ſubiected vnder them, beſide they contayne or hold the inward parts within their precinct, and keepe the body warme.

Particularly when they are together contracted toward their originals, and curued inward, the ſoft entrals giuing way vnto them, and are helped by the midriffe, depreſſed vpon the retention of the breath, then doe they equally and all ouer compreſſe the lower belly, (for if they worke ſeuerall, they preſſe ſometimes one part, ſometimes another) by which compreſſion the excrements which are violently thruſt downe into the great guts and there retayned at the fundament by the ſphincter muſcle are thruſt out by a recluſion or opening of the paſſage and a relaxation of that ſphincter, and there

thereupon they be called the inſtruments of Excretion by *Galen* in the 15. chapter of his fifth booke *de vſu partium.* But becauſe the compreſsion is equall from euery part, theſe excrements ſhould as well be preſſed vp to the ſtomach, as downe to the fundament, ſauing that the midriffe by his oblique ſituation and the breath retayned, doth driue them downward and helpe Excretion. They aſsiſt the Mother alſo in the time of the birth, by conſtringing or binding the *Hypochondria* and by drawing downe the ribs. They help alſo the motions of the Cheſt, for ſayeth *Galen* in the 14. chapter of the fift booke *de vſu partium*, they forme the voyce, ſerue to Inſpiration and Expiration and in ſtrong Efflations, as when a man windeth a Horne: yea ſayeth *Galen* they helpe vs alſo to hould our breath.

Wherefore becauſe theſe Muſcles doe night and day aſsiſt the breaſt in Reſpiration and the lower belly but at ſometimes when wee would vnburthen it, therefore they may be thought to be principally ordayned for the motion of the Cheſt. Againe, becauſe the Cheſt hath many other Muſcles which doe diſtend and contract it, but the lower belly theſe alone; it may therefore bee imagined that their primary vſe is to bee referred to the lower belly, their ſecondary to the Cheſt.

Finally, if each Muſcle worke by it ſelfe, then the oblique deſcendent drawes the haunch obliquely to his owne ſide, the right to the right ſide, the left to the left: the oblique aſcendent leadeth the cheſt obliquely to the haunches; the tranſuerſe drawes the paunch, the right into the right ſide, the left into the left. The worke of each muſcle alone,

It is alſo worthy obſeruation that the figure of theſe Muſcles whether they labour or reſt at quiet, is other and different from the figure of other muſcles: for theſe of the *abdomen* before they worke are crooked, & in their contraction hauing ſoft bodies vnder them they are bended or crooked inwarde: all other muſcles whileſt they are at reſt are right, when they labour they are curued and bent outward, becauſe of the bones againſt which otherwiſe they ſhould offend. And thus much of the Muſcles of the *Abdomen*: now we proceed vnto the backe. Their figure why differing from other muſcles.

CHAP. XXXV. *Of the Muſcles of the Backe.*

THe Muſcles of the Backe as alſo of the whole Spine are ſo diuers, ſo mixed and knit together, that ſome Anatomiſts daue deuided them into more, others into fewer muſcles, being led thereunto by reaſon of the infinite originals of the fibres and the multitude of their inſertions. All this variety *Arantius* doth very wiſely aſcribe to the admirable wiſedome of Nature, who hath therefore intertexed and wouen one within another theſe Muſcles of the Backe, yea rather allowed them continual and indiuiſible particles, that they might the better ſuſtain and accompliſh thoſe ſtrong and violent actions ouer which they haue the commaund. For if power vnited be the ſtronger, then certainly if many muſcles doe conſpire together into one motion they will bee better able to abſolue it. The Muſcles therefore of the Backe together with the racke-bones were made to rayſe vp and there to hold the whole bulke of the body, which is eſtabliſhed vpon the holy-bone as vpon his foundation. We ſay therefore with *Galen* in the 24. chapter of his Book *de diſſect. muſcul.* that becauſe theſe muſcles cannot by any meanes be truely ſeparated, either there muſt bee ſo many payres as there be racke-bones, or elſe we muſt ſay that there is one only paire offering tedinous diſtributions to all the *vertebræ*. And of this payre if one Muſcle worke, the ſpine is extended and inclined into his ſide; when they both woorke equally, the Spine bending on neither hand by reaſon of their intention or remiſsion is recurued backward. Why the muſcles of the backe are ſo wouen together. They haue no antagoniſts.

But whereas almoſt all Muſcles haue their Antagoniſts, that is, the authours of a contrary action to theirs (and therefore haue experience of their mutuall action and paſsion with an interpoſition of reſt in the middle figure) yet notwithſtanding theſe muſcles of the Spine (if you except the bending muſcles of the necke) haue no Antagoniſts or contraries.

For becauſe the inner Region of the Cheſt and the Loynes are deſtinated to thoſe moſt noble entralles which ſerue for Reſpiration or Nouriſhment, it ſeemed not good to Nature to aduenture to impeach their actions by any inſtruments of voluntary motion. Whence it is that when theſe Muſcles are relaxed (as they are in old men as well by reaſon of the waight and weakneſſe of the body, as alſo becauſe they abound with Phlegmatick humors) they are not able to containe or hold the body vpright. Notwithſtanding Anato-

Foure paires of the backe.

natomiſts, becauſe they haue obſerued eſpecially in Dancers and Tumblers, that the back is moued forward, backeward, to the ſides, and almoſt ſemicircularly, they haue reſolued that for the performance of theſe motions there are on either ſide foure muſcles, *Laurentius* maketh ten. *Siluius* but ſixe.

The firſt payre are called *Quadrati* the ſquare muſcles, [Tab. 17, ΣΣ, Tab. 11, & 29. Σ.] they ariſe broad, thicke and fleſhy from the backward and vpward cauity of the haunch-bone, and from the inner and vpper of the holy-bone, and lye as it were ſquare vpon the rackes of the loynes, vp which they climbe on the inſide of the *Abdomen*. There they are a little ſtreightened and cleauing to the tranſuerſe proceſſes of the rackes of the loines are fleſhily inſerted in the lower part of the twelfth rib.

The fibres of this muſcle do aſcend from without inward and obliquely vpward, and thoſe which proceede from the holy-bone are inſerted into the loweſt rack of the loines: the reſt of the fibres which ſucceede theſe toward the haunch-bone, doe by degrees determine into the vpper rackes, ſo that in the whole courſe of this muſcle the fibres are inſerted to the tranſuerſe proceſſes of the rackes of the loynes, and to their ſides.

Their vſe is to bend the rackes of the loynes or the lower part of the backe with the right motion forward, but if one of them worke alone, then is the flexion oblique and the backe drawne to one ſide and together forwatd. The forme of this muſcle in dogs and apes differeth much from his forme in men.

[*Table 29. is the ſame with Table 12. folio 770.*]

The ſecond payre called *Longiſſimi*, [Tab. 10, 11, 35] are indeed the longeſt muſcles in the whol body of man, for they reach from the lower end of the *holy-bone* vnto the firſt racke-bone of the cheſt, ſometime to the mamillary proceſſe of the temple bones. They

Poſition. are like the fift paire of muſcles of the cheſt called *Sacrolumbi*, [Tab. 11, r] to which in their originall and their proceſſe thorow the loynes, they do grow as if they were a part of that paire. They are alſo the largeſt of all the muſcles of the backe.

They ariſe with a very neruous, ſtrong, and acute originall [Tab. 12,] from the top of the ſpine of the *holy-bone* [Tab. 11, t] paſsing through his length and from the ſpines of the fiue racke-bones of the loynes.

In the inſide of the haunch-bone [tab. 29, Φ] where they are ioyned to the *holy-bone* they produce a neruous originall, ſaith *Fallopius*: a fleſhy, ſaith *Veſalius*, vnder which neruous originall as vnder a certaine ligament or couering lurketh another originall very fleſhy.

From hence aſcending at the outer-ſide they become fleſhy and are inſerted in the tranſuerſe proceſſes of the racke-bones of the loynes: as alſo into all the tranſuerſe proceſſes of the racke-bones of the cheſt, growing by degrees narrower from the eleuenth into the firſt, where they offer one neruous tendon on the inſide like a neruous handle, [Tab. 11, MM] which is ſpread vpward obliquely toward the outſide, like as the muſcles cal-

Termination. led *Sacrolumbi* did from the out-ſide offer a tendon along all the ribs. Sometime alſo they determine into the firſt *vertebra* of the cheſt: ſometime departing frō the proceſſes they aſcend vnto the mammillary proceſſe of the temple-bone and there end.

On their inſide becauſe of the thickneſſe of the fleſhy part and the tenuity or ſlender-

A ſinus in thē. neſſe of the neruous, there is grauen through their length a certaine *Sinus* or boſome, [ta. 29, betwivt φ and a] to giue way to the third muſcle of the backe which is called *Sacer*.

Their vſe is directly to extend the backe and the loynes if they be contracted together *Columbus* and *Archangelus* thinke that they bend the whole backe & head alſo backward, ſo that our body thereby may be compaſſed into a halfe circle, which kind of Poſture we may ſee in Tumblers when they play their feates. But if one of them onely be contracted, the ſpine is extended on one ſide, for their fibres are oblique.

The third paire are called *Sacri*, or the holy muſcles, [Tab. 29, Ψ] They lye vnder the former.

They ariſe both touching one another, [Tab. 29, Υ] with an acute originall from the vtter part of the holy-bone where the ſpine is faſtened with the haunch-bones; as alſo frō the trāſuers proceſſes & the roots of the ſpines of the rack-bones of the loines, [ta. 29, ϑ] or if you pleaſe ſay with *Fallop.* that they aſcend frō theſe proceſſes & are increaſt with diuers originals,

originals; as alſo from the racks of the cheſt, and that with a threefold originall, one higher from the end of each tranſuerſe proceſſe; another lower, as it were from the roote of the ſame proceſſe, the third from the ſpines of each racke bone: ſo that they ſeeme to bee three kinds of muſcles mixed together; one outward hauing long fibres, another inward hauing ſhort, a third hauing yet ſhorter which ariſeth from the ſpines. After their originall they grow brode by degrees, but before their termination which is acute and made into the ſpine of the twelfth, ſometimes of the eleuenth ſponder of the cheſt, they become ſlenderer. Their fibres run obliquely vpward and inward. Their vſe is, if they worke together and contract their fibres to extend that part of the ſpine to which they are faſtened. But if one of them alone worke, it extendeth a part of the backe obliquely, and putteth the body on the one ſide into a ſemicircular forme. Termination and vſe.

The fourth paire are called *Semiſpinati*, [Tab. 10. 11. 29. 25. a.] they ariſe with an acute originall from the ſpine of the twelfth rackebone, ſometimes of the eleuenth of the cheſt; and ariſing vpward by degrees they grow thicke and fleſhy, eſpecially at the ſpine of the fifth racke of the cheſt being intertexed or wouen with neruous fibres: they imbrace all the ſpines of the rackes of the ſame. Preſently after they become attenuated and doe determine with an acute end into the ſpine of the firſt rackebone of the cheſt. Their fibres are moſt what right. Theſe muſcles as alſo the former paire do fill vp the diſtances betwixt the ſpines, where they are contigual, that is, touch one another. And nothing beſide a membranous ligament iſſuing from the vpper ſpine into the lower commeth betweene them. Originall. Termination Fibres.

Their vſe is to gather together the ſpines whereinto they are inſerted, and to extend or lift vp that part of the backe to which they grow; or the backe properly called *Dorſum*, together with other muſcles the loynes being vnmoued. VVhen one of them onely worketh it mooueth the backe to the ſide; but when all eight muſcles conſpire together, the whole backe is bowed directly downeward. If foure worke together ſo as one follow another, they mooue it into a ſemicircle: but if the muſcles that be on the one ſide do work alone, the body is inclined to that ſide. And thus much of the muſcles of the backe. Their vſe.

CHAP. XXXVI. *Of the muſcles of the Fundament, the Bladder, the Teſticles and the Yard.*

BEcauſe Man was a politique creature, made for Action and contemplation, it was not fit that he ſhould either receiue his nouriſhment, or auoyde his excrements perpetually as plants doe, but at his owne choyce. As therefore in the Chops there are muſcles ſeruing for diglutition or ſwallowing, ſo in the end of the guts and the outlet of the vrine, there are muſcles ſet as porters to interclude the paſſage vnleſſe we liſt to open it.

The muſcles therfore of the Fundament are foure, two *Sphincters*, and two *Leuators*: one of the ſpincters is fleſhy [ta. 30. fig. 1. B.] ariſing from the lower racks of the holy bone, and like a ring is ſo implicated with tranſuerſe fibres to the extremity of the right gut, that it altogether ſhutteth the fundament. The other ſpincter is fleſhy, and in my iudgment, ſaith *Laurentius*, ſeemes to be nothing elſe but hardened skinne wouen with fleſhy fibres, therein following *Galen* in the thirtieth chapter of his booke *de diſſectione muſculorum*: *Falopius* alſo is of the ſame mind, yet *Bauhine* maketh but one muſcle of theſe two, which ſaith he, is tyed on the backe ſide to the rumpe bone, on the foreſide with fibrous tyes to the outlet of the bladder and to the yard, to whoſe muſcles it affordeth an original as alſo to the necke of the wombe. At the ſides it is tyed with round ligaments produced out of the holy bone vnto the haunch bone, and is ſtrangely commixed with the inſertions of the *leuators*. The ſpincters

The two leuators [tab. 30. fig. 1. D. c.] doe lie vnder the bladder, they are ſmall muſcles, but neruous and broade ariſing from the ligaments of the ſhare, haunch and holy bones, thence deſcending they reach vnto each ſide of the *ſeate* where they compaſſe the gut, & [*Table* 30. *Is the ſame with Tab.* 12. *in the* 3. *Booke fol.* 126.] are inſerted into the vtter coate thereof, and the vpper part of the ſpincter, [tab. 30. fig. 1. E.] a portion of them alſo groweth to the roote [tab. 30. fig. 1. D.] of the yard, and the necke of the wombe. VVhence it is that ſome haue made them three muſcles. Two leuators.

Their vſe is after excretion to retract the fundament, and if theſe muſcles be weake or reſolued, then followeth that diſeaſe which they cal *Anprocidentiam*, or the falling of the fundament. Their vſe

The

Of the bladder. The bladder alſo hath a ſphincter muſcle ſeated in the beginning of his necke, from which it cannot be diſtinguiſhed, and indeede it is nothing elſe but a more fleſhy ſubſtance of the ſayd necke wouen with many tranſuerſe fibres, by which it is conſtringed. If this Muſcle bee either relaxed or refrigerated or wounded, the Vrine followes againſt our willes. In women it is thicker then in men, becauſe there be no proſtate Glandules.

Of the Muſcles of the Yarde we haue ſpoken before in the 8. chapter of the 4. Booke, which it ſhall not neede to repeate. Onely we remember that they are foure, two collaterall, and two called *Inferiores* or the lower Muſcles.

Of the Muſcles alſo of the Teſticles we haue ſpoken before in the 4. chapter of the 4 Booke. Remember onely that they are two and called *Cremaſteres* or the ſuſpending Muſcles. Now we deſcend vnto the Muſcles of the Legge.

CHAP. XXXVII. *Of the Muſcles of the Legge.*

BEcauſe the Muſcles of the Thigh cannot bee demonſtrated before the Muſcles of the Legge are viewed, wee will firſt ſpeake of the Muſcles of the Leg following therein the order of Diſſection. The Legge therefore is that part of the Foote in the large acception, which is betwixt the knee and the foote properly ſo called.

What the leg is. It conſiſteth like the cubit of two bones: the one beareth the name of the whole and is called *Tibia* the *Legge*; the other is called *Fibula*, we may call it the *Brace-bone*. Now the

His motions And number of his muſcles Legge is moued either by it ſelfe or by accident with three motions, for it is bent or extended directly, and it ſeemeth alſo to be mooued obliquely outward. It is bent by fiue Muſcles, extended by foure, one onely moueth obliquely. By accident the Leg is moued after the Thigh, and that is either to one ſide or about. Firſt we will entreate of the Benders.

The firſt. The firſt Bender or the longeſt [Table 31. and thoſe that follow, fig. 1, 2, 4, 7, 8, α] with which we meete on the foreſide preſently vnder the skinne; ariſeth with an acute [fig. 1, 3 7, a] neruous and fleſhy originall from the inner appendix of the haunch-bone, preſently becomming fleſhy it runneth with a decuſſation like a ſlope ſwathe thorough the inſide of the Thigh, being very ſlender and lying vpon the other Muſcles. Neare the bone it is yet narrower [fig. 1, 2, 7, 8, β] and endeth in a neruous Tendon, which is inſerted in the fore and inſide of a ſharpe line which is in the bone of the Legge [Tab. 7. c is the inſertion of the firſt ſecond and third muſcles of the Leg].

His vſe is the ſame with the two following, that is, to bend the Legge inward, and withall to lift it vpward.

The 2 muſcle. The ſecond muſcle of the Legge which is alſo called *gracilis* or the ſlender muſcle, [Ta. 31. and thoſe that follow, fig. 1, 2, 4, 5, 7, 9, β] is ſituated, eſpecially the belly of it, in reſpect of the former inward and ſo lyeth cloſe vnto it.

It ariſeth with a neruous and large originall [fig. 2. dc] at the meeting of the ſhare-bones to which alſo it groweth, and is as big and large as that commiſſure or meeting is: Afterward it becommeth narrower but more fleſhy, attayning through the inſide of the thigh vnto the knee, determineth into a Tendon exactly round at the inner head of the Thigh, not farre from the knee; where alſo the muſcle becommeth rounde before the Tendon grow from it. VVhen the Tendon is a little dilated it is inſerted into the Leg neare the firſt Muſcle but a little more inward, and it is of the ſame vſe with the former.

The third. The third bending Muſcle which is called *Semi-neruoſus* halfe ſinewy, [. Tab. 31. and thoſe that follow, fig. 2, 3, 4, 5, 6, γ] is ſeated on the backſide, and ariſeth from the vpper part of the protuberation of the haunch-bone [fig. 5, 6, f] where it is neruous and ſlender, but aboue the middle of the Thigh it becommeth fleſhy and maketh a rounde Muſcle, which deſcendeth a little obliquely by the backſide and inſide of the Thigh, at whoſe inner head it is reflected and attenuated [fig. 5. ε] and inſerted with a round tendon in a man (in Apes ſometimes it is broade) into the forepart of the Legge, where alſo the two former were inſerted, but the tendon of this third deſcendeth vnto the middle of the Legge.

The fourth. The fourth bender is called *Biceps* or the double headed Muſcle. [Table 31. and thoſe that follow, fig. 1, 3, 4, 5, 6, 10, 13, δ] It ariſeth with a neruous acute and ſlender original, [fig. 6. h] out of the lower part of the haunch-bone or out of his protuberation. Preſently after it becommeth fleſhy, and deſcending through the vtter and backſide of the thigh in the inſide thereof about the middle (where it appeareth nemous) it receiueth a fleſhy

por-

portion [fig.6.k] as it were a new muſcle ariſing out of the middle of the Thigh whereby this muſcle is ſtrengthned, for the outward part there is onely this one muſcle, but on the inſide there are foure. This portion is ſo mixed with the muſcle when it produceth his Tendon, as if another muſcle did there ariſe. [fig.6.k k] Wherefore it may be numbred for one or for two muſcles. A portion increaſing it.

Both theſe deſcending and on the outſide neruous, do end in a notable Tendon which is implanted into the acute proceſſe of the *fibula* or the *Brace*. [fig.10.i] For the behoofe alſo of this Tendon, the head of the Thigh hath a long externall *ſinus* or cauity cruſted ouer with a ſmooth and ſlippery Ligament wherin it is ſecurely conueyed, and beſide, leaſt bending obliquely that way it ſhould go out of his tract.

The fift bender is called *ſemi-membraneus* that is, the halfe membranous Muſcle. [ta 31. and thoſe that follow, fig. 2,3,4,5,6,13, ε ε] It runneth through the backeſide of the Thigh, and ariſeth with a neruous and acute originall from the appendixe or protuberation [fig.6.m] of the haunch-bone neare the head of the third Muſcle. [figu.6.f] It continueth neruous longer then any Muſcle of the body, but at the middle of the Thigh it beginneth to be fleſhy, and in his lower part thick, and neare the knee endeth into a round Tendon, [figu.6.] wherewith a little dilated it is inſerted into the inner ſide of the Legge, with the firſt ſecond and third Muſcles. The fift.

This Muſcle alſo being very liuid in the backpart beyond the middeſt hath a boſome or cauity in it, [fig.6.n] Whereuppon the forepart of the third Muſcle leaneth, and in his whole courſe applyeth it ſelfe thereto, ſo that they appeare to be but one muſcle.

The ſixt Muſcle of the Legge or the firſt extender which is called the *membranous-Muſcle*, [Ta.31. and thoſe that follow fig,1,2,4,7,8,r] occupyeth the outward and middle part of the Thigh, & ariſeth [fig,1,4,7,p] fleſhy and ſharpe from the Spine of the haunch-bone: and being conuayed to the ioynte of the hip (at which place onely it is fleſhy) and becomming narrower it departeth neare the outſide of the greater proceſſe of the thigh, into a very long and broad [fig.7.*] membrane of the nature of a tendon, then which ther is no greater in the whole body, for like a skinne or a tranſuerſe Ligament it compaſſeth almoſt all the Muſcles of the Thigh (but it is not in all places alike thicke) and holdeth them in their proper ſeates (as we ſaid before the Muſcles in the cubit were inueſted) and incloſeth alſo the ioynt of the knee. The ſixt or the firſt extender.

This Tendon at his inſertion is mixed with the Tendons of the following Muſcles, and is infixed into the forepart and vtter ſide of the Legge. His vſe is to extend it directly and to moue ſtraight forward.

The ſeauenth or the ſecond Extender, which is alſo becauſe of his greatneſſe called *Vaſtus externus*, *The Vaſt Externall Muſcle*, is wholly liuid [Ta.31. and thoſe that follow fig 1,3,4,5,6.8,9,10,13,H] and occupieth the outſide of the Thigh, as alſo a great part of the foreſide and the backeſide. The ſeauenth

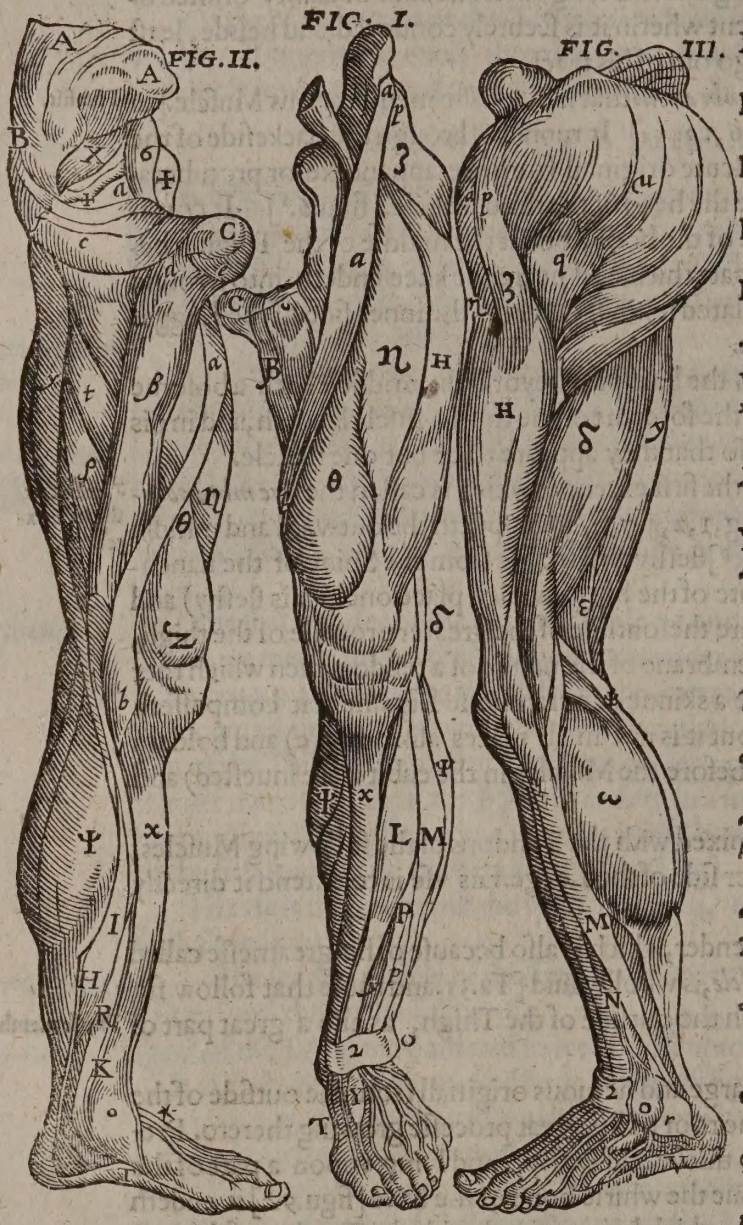
It ariſeth [fig.9.s] with a broade large and neruous originall from the outſide of the Thigh, and compaſſeth round about the root of his great proceſſe growing thereto. Preſently after the originall it becommeth thicke and fleſhy, and lying vppon a part of the eight, it is wholly fleſhy, and a little aboue the whirle bone of the knee [figu.9.x] it endeth into a large and membranous Tendon, which being mixed with the Tendon of the two following muſcles, deſcendeth at the outward ſide of the ſame whirle bone which it doth encompaſſe: and is inſerted [fig,9,u] into the foreſide of the Leg immediately vnder the ioynt.

The eight or the third Extender which is called *Vaſtus internus*, *The Internall Vaſt-Muſcle*, [Ta,31, and thoſe that follow, fig,1,2,4,5,6,7,8,10,11,12,13,14,θ] compaſſeth on the inſide almoſt all the circumference of the Thigh-bone. The eight.

It ariſeth fleſhy from the necke [figu,10,y] of the Thigh, and preſently becomming fleſhy, a portion of it groweth out of the roote of his great proceſſe as if it had a double originall. This latter originall, if you liſt ſo to call it, deſcendeth large and oblique, and becomming by degrees more fleſhy it buncheth or beareth out at the inſide of the Thigh neare the whirle-bone into a thicke and fleſhy ſemicircle, out of which groweth a ſtrong Tendon which occupyeth the whirle-bone alſo. [fig,9,u] This portion ſome doe make a diſtinct muſcle and call it *Crureum*. [figu,2,7,8,9,Z] This Muſcle with the former maketh a *ſinus* or boſome very liuid, [fig,9,char.1] that the ſubſequent muſcle might lye vpon it throughout his length.

Table 31 With thoſe that follow, ſhew the ſixe muſcles of the Legge, the Thigh, and of the foote. Fig. 1. ſheweth the fore and muſculous part of the left Thigh. Fig. 2. ſheweth the internall and later all part of it. And fig. 3. ſheweth the externall later all part of it.

TABVLA XXXI.



A A, The holy-bone.
B 2, A ligament drawne from the holy-bone vnto the hip.
G 1,2, the ſeate of the holy-bone.
H 2, the third muſcle extending the ſoale called *Plantaris*.
I 1, the fourth muſcle extending the foot or the ſoale muſcle.
K 2, the fift muſcle extending the foote, called *Tibiæus Poſticus*.
L 1, the firſt muſcle bending the foot called *Tibæus anticus*.
M 1,3, the ſecond bender of the foote called *Peronæus primus*.
N 3, the third bender of the foote called *Peronæus ſecundus*.
P 1,3, the ſecond extender of the toes, or the ſtretchers.
R, the ſecond bender of the toes, or the great bender.
T 1 2, the lower abductor of the great toe
V 3, the abductor of the little toe,
* 2, Tendons carried vnto the toes of the foote.
X 2, the internall part of the fourth muſcle of the thigh as it were three-fold, at *a, c, f*.
Y 1, the vpper abductor of the toes.
a c f, A part of the tenth muſcle of the thigh as it were three-fold at *a c f*, and carried vnto the great proceſſe of the thigh.
† 2, A great nerue lying vppon the tenth muſcle betweene *x* and *a*.
α 1,2. the muſcle of the leg, or the firſt bender which is the longeſt muſcle.
a 1,3, His originall. *b* 1 2. His tendon.
β 1 2, the muſcle of the leg or the ſecond bender which is the ſlender muſcle.
de 2, His originall. *d* His tendon.
γ 2,3, the third muſcle bending the tibia called *Seminerueſus*.
δ 1,3, the fourth muſcle bending the leg, called *Biceps* or the double headed muſcle.
εε 2,3, the fift muſcle bending the legge called *Semimembraneus*.
ζ 1,2, the firſt muſcle extending the legge called *membranoſus*.
η 1,3. the ſecond muſcle extending the leg called *Vaſtus externus*. *θ* 1 2, the third muſcle extending the leg called *Vaſtus internus*. *κ* 1,2,3, the fourth extender of the leg, or the *Right* muſcle. *μ* 3, the firſt extender of the thigh, called *Glutteus maior*. *o* 2. the inner anckle. *o* 1,3, the vtter anckle, *ϱ* 1, A fleſhy part of the firſt extender of the leg, *ϱ* 2, the fift extender of the thigh called *Triceps* or the three headed muſcle. *σ* 2, the firſt bender of the thigh called *Lumbalis*. *τ* 2, the ſecond bender of the thigh called *Illiacus*. *υ* 1, the third bender of the thigh. *ϕ* 1,2, the firſt extender of the foote, or the internall *Gaſtrocnimius*. *ω* 1,2,3, the third extender of the foote, or the external *Gaſtrocnimius*. *p* 1, A portion of the ſecond extender of the toes, which *Veſalius* maketh the ninth muſcle of the foote. *q* 3, the greater proceſſe of the thigh called *Rotator*. *r* 3. the tranſuerſe ligament reaching from the brace to the heele. *t* 2, A portion of the 5. muſcle of the thigh. *x* 2, the bone of the legge bare. *y* 1,3, the tendon of the firſt extender of the toes. *z* 1 3, A tranſuerſe ligament aboue the foote.

The ninth or the fourth extender called alſo the right muſcle, [Tab. 31, and thoſe that follow fig. 1,2,3,4,7,8,9,*] lyeth on the outſide vppon the firſt bender, and is ſeated on the middeſt of the forepart.

It ariſeth with a neruous and acute originall [figure 8, character 1] from the internall protuberation of the haunch bone on the fore-ſide aboue the Cuppe of the Coxendix.

From

From thence it is deriued directly through the length and forepart of the thigh betweene the ſeuenth and the eight muſcles, and being by degrees increaſed with a fleſhly ſubſtance it becommeth againe by degrees more ſlender aboue the middle of the thigh, [fig.8.char.2.]and determineth into a very long and exceeding ſtrong tendon aboue the whirle, where it is a little narrower and more ſlender.

But in the forepart of the whirle it is againe dilated, and being mixed with the tendons of the two forenamed muſcles is very ſtrongly inſerted to the leg on the foreſide immediatly vnder the ioynt. But in Munkies it is moſt what membranous and inſerted into the leg much lower. Neither this onely, but alſo the tendons of the other muſcles are more membranous and broder in men then in Apes. And with this tendon of the three muſcles is the whirle bone couered, yea it groweth to his forepart, and ſerueth the knee for a ligament. Munkies.

This is the muſcle which is like a Snake or the fiſh (becauſe of his broade tayle) which is called *Mus* or the *Mouſe*, which vſhereth the Whall that he offend not againſt the rockes, from which fiſh the muſcles of the whole body haue their denomination.

The tenth and laſt muſcle of the leg is called the *oblique moouer*, and from his ſittiation *poplitæus* the muſcle of the Ham, [tab.34.38.fig.14.16.28.ΛΛ,]for it lurkes in the ham vnder that muſcle of the foote whichis called *Gaſtrocnimius*, and *Plataris* next of al to the bones, and therefore we canot meete with it before theſe bee remoued. It is a ſhort and ſlender muſcle and iſſueth with a neruous [fig.16. char. 4.] and round originall from the externall head of the thigh, after it is increaſed with fleſhy fibres and running vnder the ligament, climing obliquely ouer the bone *Tibia* or the leg, determineth brode and fleſhy and is inſerted into the backe and inner part of the legge at his appendix. [Tab. 31. char.5. The tenth.

His vſe is to mooue the leg obliquely outward, and therewith alſo to turne the foote ſomewhat inward toward the other, for the foote is ſpecially articulated with the legbone, and therefore *Galen* ſayd that it was the principall author of the bending of the leg.

CHAP. XXXVIII. *Of the muſcles of the Thigh.*

THE Thigh is that part which is betwixt the ioynt of the huckle bone and the knee, and conſiſteth of one bone as doth the arme. This part becauſe it is moued according to our good pleaſure by reaſon of his round head, and that with all kind of motion, it ſtood in neede to haue muſcles and thoſe very many.

Theſe muſcles doe mooue the thigh either directly or in compaſſe. Directly, either lengthwiſe or ouerthwart, and that either by extention or by flexion. It is extended either when we ſtand vpright and make (as we ſay) a curteſie, bending the thigh moderately inward and downeward toward the earth. Or backeward into the poſterior part when wee lift our thighs vpward, eſpecially toward the outſide; which kinde of poſition may bee ſeene in that they call a *Backe caper*. This extention is made by the helpe of fiue muſcles, which moſt what doe occupie the poſterior part. And the firſt foure of theſe doe lie vpon the huckle bone, and the fifth vpon the thigh. The motions of the thigh.

The thigh is bent when we lift it vpward and forward, and eſpecially toward the inſide; (in extenſion it is toward the outſide) as it is in Anticke dances, and this motion is performed by three muſcles ſituated before; two of them are ſeated in the cauity of the belly, and the third in the thigh. 11. muſcles of the thigh.

The circumaction or compaſsing of the thigh is either inward or outward, and performed by three muſcles placed in the coxendix. VVee conclude therefore that there are eleuen muſcles of the thigh, although I know many more may be named if we diuide the fifth muſcle into foure; make two of the fleſhy pouch which compaſſeth the tendon of the tenth muſcle, & adde the twelfth muſcle deſcribed by *Arantius*: for then each thigh ſhall haue ſeuenteen muſcles which ſhall extend it, bend it, leade it in compas, draw one thigh two another, diuide them aſunder, or lift one thigh ouer another, as Taylers vſe to ſit at their worke. Of all which motions we will ſpeak in order.

The firſt extender is called *Glutæus maior* the greater *buttocke muſcle*, becauſe it maketh almoſt all the buttocke on one ſide; [tab. 31. and thoſe that follow fig. 3. 4.8.μ.]for it is thicke and fleſhy and lyeth iuſt vnder the skin, being appointed with the two following to make the quiſhion of the ſeate.

It ariſeth with a fleſhy broade and ſemi-circular originall, from the whole circumference of the haunch bones, from the lower part of the holy bone where it is contiguous with his oppoſite, and from the beginning of the rumpe bone. [tab. 32. fig. 4. a b c.] Afterward deſcending a little obliquely and riding ouer the ioynt of the huckle-bone which it ſtrengthneth, as it were, with a couering it becommeth narrower and more ſlender, and ſo endeth into a ſtrong and brode tendon, which is partly inſerted into the roote of the greater proceſſe, partly below it into the outſide of the thigh bone, and that obliquely.

The vſe of this muſcle is when it worketh all together to ſettle the backeward and

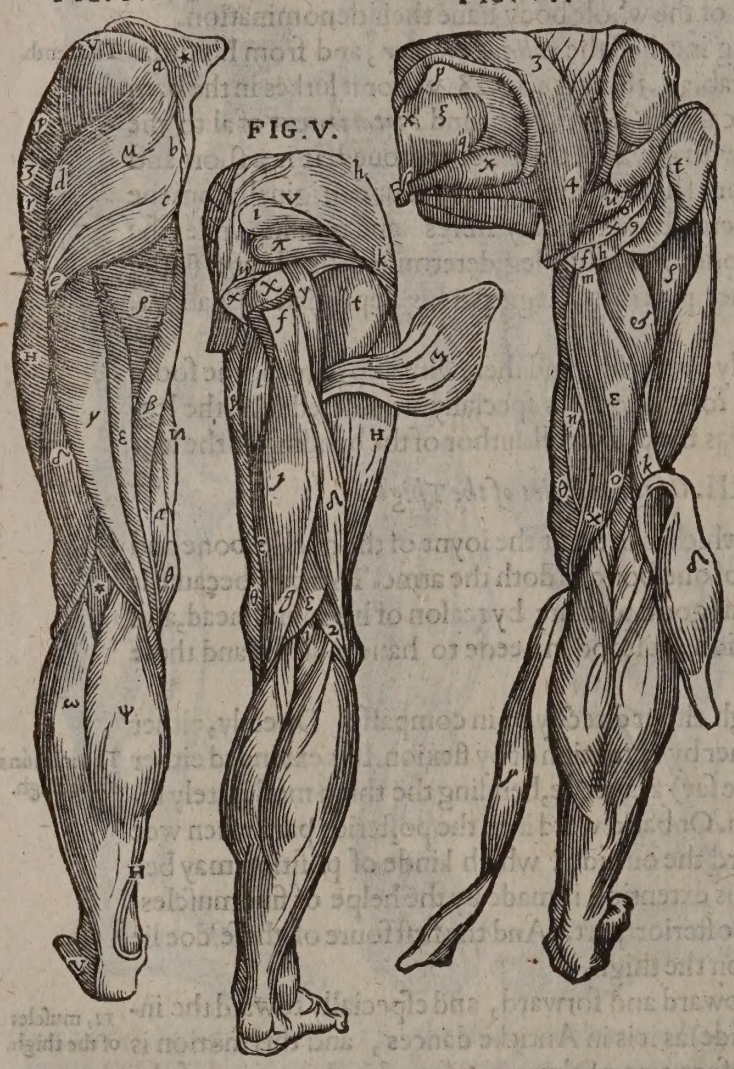
Table 32. Sheweth eſpecially the Muſcles of the Thigh and the Legge.

TABVLA XXXII.

FIG. IV.

FIG. V.

FIG. VI.



α 4, The firſt muſcle of the leg called *Longiſſimus.*

β 4,5, the ſecond muſcle of the leg called *Gracilis.*

γ 4,5,6, the third bender of the leg called *Serminerueſus.*

δ 4,5,6. the fourth bender of the leg called *Biceps.*

ε 4,5,6. the fift bender of the leg called *Semimembraneus.*

ζ 4, The firſt extender of the leg called *Membranoſus.*

η 4,5,6. the ſecond extender of the legge or the muſcle called *Vaſtus externus.*

θ 4,5,6. the third extender of the legge called *Vaſtus internus.*

ι 4, the fourth extender of the leg called *Rectus* or the Right muſcle.

μ 4,5, the firſt muſcle extēding the thigh called *Gluttæus maior.*

ν 4,5, the ſecond extender of the thigh called *Gluttæus medius.*

ξ 6, the third extender of the thigh called *Gluttæus minor.*

π 5, the fourth extender of the thigh called *Illiacus externus.*

ρ 4,6, the fift extender of the thigh called *Triceps* or rather *Quadriceps.*

σ 6, the hinder part of this muſcle.

χ 5,6, the firſt circumactor or the muſcle leading the thigh about called *Obturator internus,* together with fleſhy portions both aboue and below, and growing vnto it.

τ 4, the firſt extender of the foote called *Gaſtrocnimius internus.*

υ 4, the ſecond extender of the foote called *Gaſtrocnimius externus.*

α b c, 4, the originall of the firſt extender of the thigh.

d e, His inſertion.

f g, 5,6, the originall of the third bender of the leg called *Semineruoſus* at *f*, the beginning of his tendon at *g*. i k, 5, the ſemicircular originall of the ſecond extender of the thigh at *h*, His inſertion into a proceſſe of the thigh. *b* 6, the head of the muſcle called *Biceps*, or the fourth bender of the leg. *k* 6, A fleſhy portion whereby it is increaſed. H 4, the fourth extender of the foote called *Plantaris*. *l* 5, A portion of the fift muſcle extending the leg, or of the muſcle called *Semimēbraneus*. *m n o* 6, His head *m*. The beginning of his tendon *o*. A boſome or cauity in which the third extender of the leg doth reſt, *n*. *r* 4, A fleſhy part of the extender of the leg, called *membranoſus* at *p* His originall. *p* 6, the backe of the haunch-bone bare. *ſ x* 6, the circumſcription of the third bender of the thigh, *ſ* 6, the inſertion of the third and fourth extenders of the thigh, *t* 5,6, the great and vtter proceſſe of the thigh. *u* 5,6. A ligament going from the holy-bone into the acute proceſſe of the hip, x 5, A ligament going from the holy-bone into the back-part of the hip. *y* 5, the fourth nerue which is the greateſt nerue of the whole legge, wherein is the tumor collected which cauſeth the hip-gowte. * A ſinus or cauity wherein the great veyne of the legge and the artery together, with the nerue are conueyed. 12, char. 6, the fourth nerue parted into two in the ham, the greater branch 1, the leſſer 2. 34, charact. 6, the membranous beginning of the oblique aſcendent muſcle of the *Abdomen* from the ſpine of the backe. 8,9, charact. 6, Two fleſhy portions, or the *fleſhy pouch*, and heauing to the ſecond *Circumactor*, or compaſsing muſcle of the thigh.

to

to extend it directly; for if but one part of the muſcle bee contracted, then the motion is not equall but more outward to this or that ſide.

The ſecond extender which is called *glutæus medius*, the middle buttocke muſcle [tab.32.and thoſe that follow fig.4.5.8.9.ᵛ.] lyeth for the moſt part vnder the firſt. The reſt of it is couered with a membrane. It is alſo like the firſt in forme, but leſſe and very liuide, as alſo is the third in leane bodyes, but in thoſe that are fat eſpecially in women we often find neruous fibres running through them to which fat groweth, to make the ſeate the ſofter. The ſecond.

It ariſeth with a fleſhy, broad and ſemicircular originall, [Tab. 32, fig. 5, *hi*,] (a little lower then the firſt to whoſe originall it giueth way) from the rib of the haunch-bone on the fore-part and from the backe of the ſame haunch, and indeede it occupieth almoſt all the circumference of that bone: thence deſcending obliquely it groweth narrower by degrees, runneth vnder the forward muſcle, couereth the ioynt of the hippe, and determineth into a broade, ſtrong, and membranous tendon, [fig.5.k.] which is implanted into the fore and vpper part of the great *Trochanter* or proceſſe of the necke of the thigh, which it compaſſeth on euery ſide but ouerthwart.

His vſe is to extend the thigh and to draw it vpward and forward into one ſide, and that more manifeſtly then the former muſcle. The fibres alſo of this muſcle make a decuſſation with the fibres of the former, [Tab.5, μ with ν.]

The third *Extender* called *Glutæus minor, the leſſer buttocke muſcle* [tab.32.and thoſe that follow fig.6.10.ξ.] lyeth wholy vnder the ſecond, and is ſo much leſſe then it, as the ſecond is leſſe then the firſt. It ariſeth from the backe of the haunch bone, and from his backeward and lower part where the bone of the coxendix beginneth; and his original, (as the two former) is fleſhy, thick, and ſemicircular. [fig.6.ᵍ ˣ.] Then declining downward and forward, it cleaueth eaſily with fibrous tyes to the ligament of the ioynt of the hippe, and becomming narrower determineth into a brode and ſtrong tendon, which climing ouer the greater *trochanter* or proceſſe of the thigh, is implanted to the very top of his forepart, where it is a little inuerted. [fig.6.ᵍ] The third.

His vſe is to drawe the thigh moderately vpward and backeward, and ſo to extend it.

The fourth extender called *Iliacus externus pyriformis, the outward haunch peare muſcle* [tab.32.fig.5.6.and tab.34.fig.13.π.] becauſe it filleth the outward and lower cauity of the haunchbone with his oblique poſition, and is like a round peare. This muſcle is liuide, and ariſeth with a fleſhy and round originall from the three lower rackes of the holy bone, or from the inner part of the ſides, where ſomtimes it is continual with his oppoſite: thence it runneth downeward but fleſhy and ouerthwart to the great *trochanter*, but before it touch the thigh it becommeth narrower and endeth in a round tendon, which is obliquely implanted into the great *trochanter* or head of the thigh on the backeſide neare his appendix. His vſe is to draw the thigh moderately vpward and backeward, and ſo to extend it. It is alſo ſome litle helpe to leade the thigh round but forward, yet more then the third muſcle. The fifth extender is comonly called *Triceps* becauſe it hath a threefold originall, but may better be called *Quadriceps*, for his originall is fourefold. [Tab.31.and thoſe that follow fig.2.4.6.8.9.10.11.12.13.14.ᵖ.] This is the thickeſt muſcle in the whole body of man, and ſtuffed with a wonderfull variety of fibres, inſomuch that becauſe the parts thereof doe differ among themſelues in their originall, fibres, inſertion, coates, and in ſome ſort in their vſe likewiſe, *Falopius* ſaith, and ſo may we alſo, that there are ſo many muſcles as there are parts of this muſcle, to which alſo the right muſcle which ſeemeth to be a part thereof muſt be referred, whoſe originall is ſeated vnder the three heads of the muſcles which make the bulke of the leg. [Tab.32.fig.6.ᶠ ʰ ᵐ.] But we wil here vnder exhibite his diſcription according to *Falopius*. The fourth. The fifth. The thickeſt muſcle of the body.

The firſt part [Tab.35.fig.12.a part of the muſcle is at ν.] ariſeth with a neruous originall from the vpper line of the ſhare bone, and deſcending is inſerted into a rough line of the thigh vnder the middle. Notwithſtanding from his tendon proceedeth a ſlender portion which is vnited with the tendon of the fourth part and is inſerted into the lower head of the thigh, and the inſide of the knee.

The ſecond part [Tab.35.and 34.fig.13.and 14.char.6.] ariſeth from the lower parts of the commiſſure of the ſhare bones where they ioyne together. It is fleſhy and broade and hath oblique fibres, deſcending alſo downeward, it is implanted into the line of the thigh in the vpper part thereof.

Third part[ta.34.fig.13.char.6.fig.14.char.7.confered fig.13.ſ σ υ, among themſelues] ariſeth with a fleſhy, ſometimes a neruous originall from the apendix of the *Coxa* yea from the whole coxendix round about the circumference of his brode hole, his fibres are very diuers, ſo that it ſeemeth to be a double muſcle, for the vpper fibres are as it were, tranſuerſe, but many of the lower oblique. This part deſcending is inſerted into a rough line vnder the little *trochanter* or head of the thigh.

The fourth part, [Tab.34.fig.12. and 13.ſ μ x y, ariſeth with a neruous fig.13.μ.] and then fleſhy [x] originall from the the appendix of the *coxa*, which two originals forme a muſcle whoſe belly is dilated into a ſtrange breadth [fig.13.ρ] afterward running along the backeſide of the thigh, it endeth into a round tendon [fig. 13. vnder z] which with a ſlender portion of the tendon of the firſt part is inſerted into the inner and lower protuberation of the thigh [three parts of this muſcle are demonſtrated, tab.36.12.ſ σ υ. where they hang downe alſo. Tab.34.fig.14.ſ 6. 7.]

α 7,8. The firſt bending muſcle of the Leg called *Longiſſimus*.
β 7,9, the ſecond bender of the Leg called *Gracilis*.
ζ 7,8, The firſt extender of the Leg called *Membanoſus*.
η 8,9, the ſecond extender of the leg called *Vaſtus externus*.
θ 7,8,9, the 3. extender of the Leg call *Vaſtus internus*.
ι 6, A *ſinus* or cauity vpon which the ninth muſcle of the thigh lyeth.
κ 7,8,9, the fourth extender of the Leg called *Rectus*.
1,2,3.char.8. The originall, 2. The tendon, 2. the place where the tendon groweth to the tendons vnder it.
μ 8, the firſt extending muſcle of the thigh.
ν 8,9, the ſecond extender of the thigh.
ρ 9, A portion of the 5. muſcle of the thigh called *Triceps*.
σ 8, the firſt bender of the thigh called *lumbalis*.
τ 8, The ſecond bender of the thigh called *Iliacus internus*.
1,2,3,char.8, His original, 1, tendon 2 the place where the tendon groweth to the tendons vnder it.
υ 7,8,9, The third bender of the thigh cald *Glutæus minor*.
ω 8, The ſecond externall extender of the Foote.
b 7,8, the tendon of the firſt muſcle of the Leg neare the knee.
c 7, The inſetions of the 1 2 and 3 muſcles of the Leg.
o 8, the inner ankle.
p q 7, the fleſhy part of the firſt extender of the leg, his large membrane at *q*.

Table 33. ſheweth ſome Muſcles of the Leg and the Foote.

TABVLA. XXXIII.

FIG. VII. FIG. VIII. FIG. IX.

r 7, his originall. ſ 8, his inſertion. t u x 9, the beginning of the 2 extender of the Leg. t. his inſertion, u. his tendon x. y 8, the tendon of the firſt extender of the toes at the great toe. C 7,8.9. the place of the ſhare-bone. H 7, the third extender of the foote called *plantaris*. I 7, The fourth extender of the foote called *Soleus*. K 8, the fift extender of the foote called *Tibiæus poſticus*. L 7,8, the firſt bender of the foote called *Tibiæus anticus*. M 8.9, the 2 bender of the foote called *Peroneus primus*. N 8,9, the third bender of the foot called *Peroneus ſecundus*. O 8,9 the firſt extender of the toes called *Pollicis tenſor*. P 7,8,9. the 2. extender of the toes. p 8,9. A portion of that muſcle which *Veſalius* maketh ths 9. muſcle of the foot. 10,11 12: char. 8. the originall thereof 10, his diuiſion into tendors 11, the inſertion of the 9 muſcle 12. R 9 the 2 bender of the toes called *Flexor magnus*. T 7: the lower abducter of the great toe. X 8: 9: the bone of the leg bare. Y 8,9, the vpper abducter of the toes. Z 7,8: the muſcle called *Crureus*. † 7. the firſt extender of the foote called *Gaſtrocnimius internus*.

The

The vſe of this Muſcle although it be to liftvp the Thigh and leade it to the body: yet according to the diuerſity of his partes it hath diuers particular offices: for the backeparte which hath right fibres, eſtabliſheth the thigh and faſtneth it vppon the ground being extended, as when a man ſettes his foote to paſe forward. The backe portion alſo of the anterior part performeth the ſame; but it leadeth the thigh moderately inward as it were to the other thigh, ſo the firſt part of the anterior leadeth the thigh inward and croſſeth one thigh ouer another. And thus much concerning the extending Muſcles, which primarily extend the thigh, and theſe alſo doe helpe it when it is moued ſidelong or ledde about. The vſe of the 5. muſcle.

The Bending Muſcles are three: The firſt is called *Lumbalis* [Table 31. and thoſe that follow fig. 2,8,10,11,12,14,16, chara. 6] the Muſcle of the Loynes which *Hippocrates* and *Galen* called ψοας. They are placed a little obliquely in the cauity of the *Abdomen*, and when the entrals are taken forth they preſently appeare in the Loines. It is a roſid, fleſhy, thicke and ſtrong Muſcle, and altogether liuid. The firſt bending muſcle.

It ariſeth fleſhy [Ta. 35. fig, 12. a] from the two lower racks of the cheſt, and the three vpper of the loynes: preſently after it climbeth ouer the reſt of the rackes of the Loynes, and deſcending fleſhy by the haunch-bone [from a to b] it runneth a little obliquely and ſomething outward aboue the ſhare-bone, and ſo determineth into a ſtrong and round Tendon which is inſerted on the foreſide at the vpper part of the leſſer head of the thigh. His vſe is ſtrongly to drawe the Thigh vpward and to bend it inward. And becauſe the tendon of this Muſcle ſhould be ſecurely conuayed, not hurt by the hardnes of the bone, nor yet erre or wander out of his way, there is a *ſinus* or cauity inſculped in the ſharebone which is couered ouer with a membranous, ſmooth and ſlippery Ligament ariſing out of the bone. And becauſe the kidneis lie vpon this muſcle ouer which a notable nerue is diſſeminated. Hence it commeth to paſſe that thoſe that are troubled with the ſtone in the Kidneyes doe find a *ſtupor* or ſleepineſſe on the Thigh on that ſide the ſtone is on.

The ſecond Bender is called *Iliacus internus* the inward haunch-Muſcle. [Ta. 31. fig 2. ψ Ta, 33. fig. 10,11,12,16, r] At the lower part it toucheth the former Muſcle [tab, 35, fig, 11,12, r as farre as σ] and occupyeth all the inner cauity of the haunch-bone. From thence as it were out of a ſemicircle it ariſeth fleſhy and broade and by degrees becommeth narrower and thicker, and deſending forward aboue the vpper part of the *Coxendix*: it is implanted with a round tendon [Ta, 34, fig, 14c T] into the leſſer head of the thigh like as the former but ſomewhat lower then the firſt bender. The 2 Bender.

His vſe is together with the firſt Bender to lift the Thigh vpward and ſo to bend it, but this Muſcle mooueth it leſſe inward. And whereas it is carried aboue the *Coxendix*, the bone hath in it a ſmooth and ſlippery cauity for the better conuaying thereof, which cauity where the muſcle bendeth it is liuid, neruous and ſtrong, the better to defend it ſelfe againſt the hardnes of the bone.

The third Bender [Tab. 31. and thoſe that follow, fig, 1,7,10,11,12 v] is alſo liuid, and ariſeth broade and fleſhy from the Line of the ſhare-bone, hard at his griſtle and runneth obliquely within the fift extender, ſo that ſome haue accoũted it for a fift part of the ſame fift muſcle, and ſo determineth into a ſhort, broade and large tendon which is inſerted at the inſide of the Thigh ouer againſt the leſſer heade and runneth out vnto the backeſide. His vſe is to leade the thigh vpward and inward very ſtrongly and ſo to croſſe one Thigh ouer another. And ſo much for the benders of the Thigh. The 3. bender.

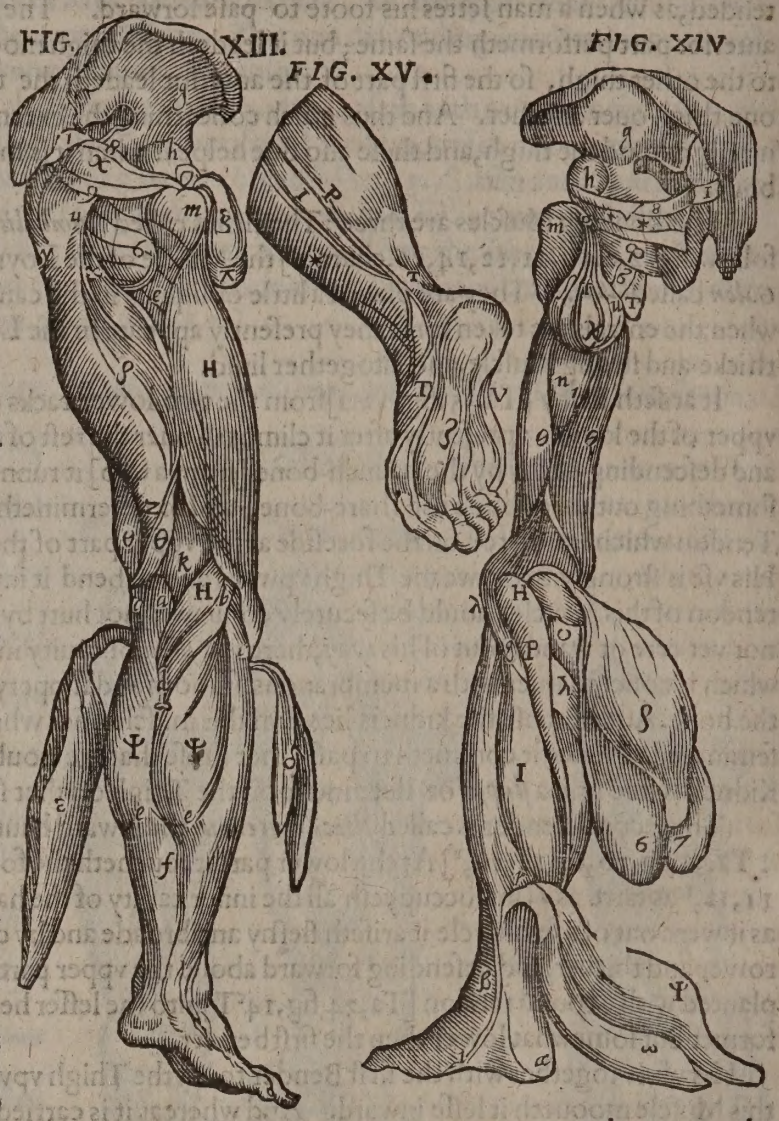
The firſt compaſſer which is called *Obturator externus* the outward filler [Tab, 35. fig. 12,14,16, φ] lyeth vnder the former & filleth vp on the outſide all the hole which is before in the ſhare and the haunch-bones. The forme of it is like a Peare as was the fourth extender. It ariſeth fleſhy and broade from the circumference of the foreſaid hole, and on the foreſide is liuid. It runneth ouerthwart and behinde by the hip ioynt away and the necke of the thigh, is by degrees anguſtated and determineth into a ſtrong and large tendon, which is implanted into a cauity of the great trochander or the head of the thigh. His vſe is to turne the thigh inward, *Laurentius* ſayth outward. The firſt compaſſer.

The ſecond compaſſer *Obturator internus* the inward filler [Ta, 31, and thoſe that follow, fig, 2, ψ acf fig, 5, 6, aboue char, 9 f. 13, 14, χ] lurketh in the bowle of the hanch-bone, occupyeth the inſide of the forenamed perforation, is ſtronger then the former, and diſtinguiſheth therefrom by a Membrane to which it groweth. It ariſeth fleſhy & broad from the circumference of the perforation on the inſide and appeareth notably liuid hauing The 2. compaſſer.

Tab. 14. *Sheweth the muscles of the thigh and of the foote.*

TABVLA XXXIV.

FIG. XIII. FIG. XV. FIG. XIV



α 14, A tendon made of three muscles of the foot & inserted into the heele

β 14, The beginning of the tendon of the first *Peronæus* out of the middle of his body.

γ 14 The tendon of the second *Peronæus* reflected to the outward ankle.

δ 13, The fourth bending muscle of the leg called *biceps*, hanging downe.

ε 13, The fifth bender of the leg called semimembraneus hanging downe.

ζ 15, A ligament in the sole of the foot seruing in stead of the brode tendon.

η 13, The second extender of the legge called *vastus externus*.

θ 13, 14. The third extender of the leg called *vastus internus*.

ι 13. 14. An acute ligament going from the holy bone into the processe of the hip bone,

κ 14, The muscle called *poplitæus* mouing the leg obliquely.

ξ 13. A portion of the third muscle extending the thigh.

π 13, The fourth extender of the thigh or a portion of the Illiack muscle.

ρ 13, 14, the fifth extender of the thigh called *triceps*.

ϵ 13. Another part of the fifth muscle.

σ 13, the first bender of the thigh called *Lumbalis*.

τ, The 2. bender of the thigh or a tendon of the internall Illiacke muscle.

φ 14, the first compasser of the thigh called *obturator externus*.

χ 13, 14, the second compasser of the thigh called *obturator internus*.

ψ 13, 14, the second extender of the foot called *Gastrocnimius externus*.

a b, 13, the beginning of the two extenders of the feete. *c c* 13, their fleshy beginning. *d* 13, Their contiguity or meeting together. *e e* 13, the swelling of both the calues. *f* 13, The beginning of the tendon of these muscles. *g* 13, 14, The backe of the share bone without flesh, *h* 13, 14, The head of the thigh bone compassed and defended with a membranous ligament. *k* 13, The place of the thigh bone without flesh. *l* 14, The rumpe bone without flesh *m* 13, 14, The exterior and great processe of the thigh. *n* 14, A rough line of the thigh whereinto is inserted the fifth muscle of the thigh called *triceps*. *o* 14, The bone of the legge and the outward head of the thigh bored. *p* 14, The tendon of the third extender of the foote. *q* 14, The beginning of the fourth extender of the foote, *r* 14, The insertion of the tendon of the first and second muscles of the foote. *s t u*, The tendons of the tenth muscles of the thigh reflected to the hanch bone. *u* 13. The neruous head of the backe part of the fifth extender of the thigh. *x* 13, The fleshy head of the same muscle. *y* 13. Carrying the proportion of a mouse. *z* 13, the tendon of the first part inserted into the inner tendon of the thigh. 6. Char. 13. the third part of the fifth muscle. 7. Cha. 14. another part of the fifth muscle. 8 9. Char. 13. two fleshy portions or the fleshy pouch which adheereth to the second compasser of the thigh. H, 13, 14, the third extender of the foote called *Plantaris*. I 14, 15, the fourth extender of the foote called *Solæus* † 15, a cauity betwixt the tendon of the forenamed muscle & the other. * 15, the place of the bone of the leg without the flesh, T 15, the lower abductor of the great toe. V 15, the abductor of the little toe

hauing three lines, or inscriptions. Afterward it is by degrees contracted or straightned, [tab. 31. fig. 2. a c. vnto f] and runneth ouerthwart aboue the coxendix outward [tab. 34. fig. 13. x.] and aboue the cauity which is formed like a pully, it hasteneth to the great trochanter where it is reflected: the reflected part being fleshy, and that which toucheth the cauity neruous. At which cauity it is increased with three round tendons [Tab. 34. fig. 14. f t u.] in the very reflection, which tendons beeing a little separated one from the other doe passe forward, and when they are past the cauity on the backe side they are againe collected and make one neruous tendon [tab. 43. fig. 13. X. 8. 9.] which tendon is led ouerthwart

thwart and together with the firſt compaſſer is inſerted into the hinder cauity or ſinus of great *Trochanter* or head of the thigh, and into his roote. And this was Natures conn-ſell determining to adde ſtrength to this muſcle; for if it had bene wholy fleſhy in his reflection and motion it would haue beene hurt by the hardnes of the bone. Wherefore alſo there groweth to the Sinus a ſtrong membranous ligament which is ſmooth and lined ouer with a viſcide humor for the more eaſie circumaction of the muſcle. But this Sinus hath appearing in it two lines lightly eleuated, which running ouerthwart doe diuide the three forenamed tendons into three cauities; ſo that in this one cauity euery tẽdon hath a peculiar Sinus.

And leaſt theſe tendons ſhould ſlip out of the cauity of the bone after they are reflected, Nature created a fleſhy purſſe wherein the tendon of this muſcle is placed, which purſſe reſembleth two muſcles, [Tab.38,fig.16,**] one vpper and another lower. The vpper [Ta.32,fig.6,char.8.as alſo the lower [ta.31,fig.6,13,14,char.9,fig. 16,*] do ariſe fleſhy and ſlender, from the acute proceſſe of the haunch-bone the vpper, the lower from his appendix, & both of them do accompany the ſecond compaſſer euen to his inſertion and are together inſerted into the cauity of the great *Trochanter*. The purſſe. like two muſcles.

Their vſe is together with the ſecond compaſſer to helpe the circumaction or compaſsing of the thigh. Their vſe.

There is alſo another muſcle firſt deſcribed by *Fallopius*, which lyeth vnder the foreſayde purſſe, [Tab.34,fig.14,*] which ariſeth ſhort and very fleſhy from the backe-part of the coxendix and being led about to the outſide of the thigh, is with a ſtrong and roũd tendon inſerted into the backſide of the great *Trochanter*, or into that ſpace which is betwixt the two *Trochanters* or heads of the thigh. *Fallopius* his 11. muſcle.

His vſe is to lead the thigh in compaſſe backeward. And this muſcle haply may be diuided into two.

Arantius after he hath deſcribed this muſcle found out by *Fallopius*, he addeth another ſo making the number of the muſcles of the thigh to be a full Iury in theſe words. *Arantius* his 12. muſcle.

When you haue cut away the muſcles which bend the legge from their originals, if you diligently marke the place, you ſhal finde vnder the eleuenth muſcle a twelfth, which is much ſtronger then the former, but lyeth very deepe. It hath an originall oppoſite vnto the eleuenth, beginning from the forepart of the ſhare-bone where it is perforated & it is diſtinguiſhed with a membrane of the nature of a Ligament. This originall ſayeth hee, is fleſhy and almoſt orbiculer or round. It degenerateth into a ſtrong and round tendon.

This muſcle being ledde about like a ſemicircle to the outſide of the thigh, together with the ſecond compaſſer and the purſſe, that is, with the tenth and eleuenth muſcles to guide the ſphericall or round motion of the thigh.

CHAP. XXXIX. *Of the Muſcles of the foote.*

THE Foote is moued two wayes directly and to the ſides; directly alſo or in length two wayes: for it is eyther extended backward when it is led out of his tranſuerſe poſition, a little obliquely toward the earth (and that by the helpe of fiue muſcles placed in the back part, together with the ſecond and third benders of the toes) as when we walke or dance: or it is bent forwarde by three muſcles to which may be added that portion of the muſcle which ſome make the ninth, but we account it for a part of the ſecond muſcle which ſtretcheth the toes: and theſe are placed together with the firſt and ſecond extenders of the toes on the foreparte, but the outward ſide of the legge, for the inſide of the legge euen vnto the calfe is without fleſh. This motion is not ſo ſtrong as the former, and therefore doth not ſtand in need of ſo great muſcles. The motions of the foote.

The foote is alſo moued to the ſides, and ſo a little compaſſed, which motion becauſe it is very weake, hath not any particular or priuate muſcles allotted thereto, but is ledde to the outſide by the anterior muſcles and to the inſide by the poſterior. The extending muſcles therefore of the foote are fiue, and the benders three. His muſcles.

The firſt *extender* is called *Gaſtrocnemius internus* [Tab.31, and thoſe that follow fig. 1, 2, 3, 4, 13, 14, ϒ] *the internall Calfe muſcle*, ariſeth from the inner head of the thigh about the knee as it were with a double originall. The one vpper [fig 13,*b*] which is fleſhy and broade: the other lower and vtter which is neruous and liuid. [fig.13,*c*.] The firſt The firſt extender.

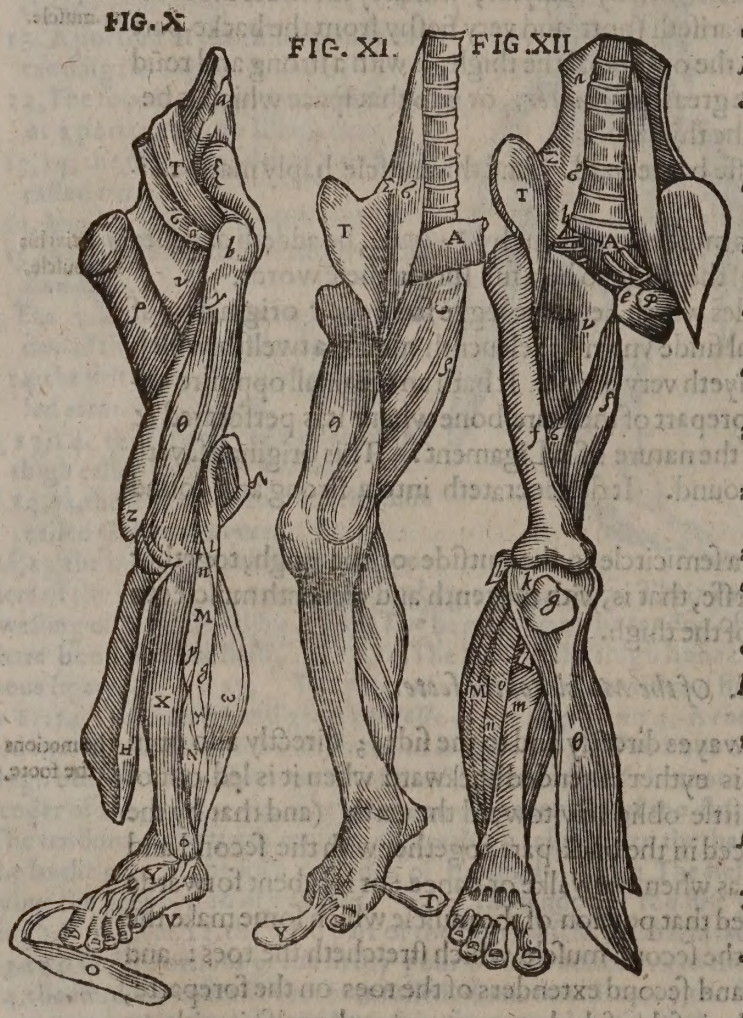
deſcending a little vnder the ioynt of the knee is confounded with the ſecond, and both together make a fleſhy and thicke muſcle which about the middle part of the legge after it hath formed the inner part of the Calfe [fig.13,aboue e] becommeth narrower and endeth into a broad [fig.13,f] and neruous tendon, in the middeſt whereof notwithſtanding a fleſhy portion ſheweth it ſelfe running a little way therein, which being vnited with the tendon of the next muſcle following, [fig.13,and 14,o] is in Apes inſerted into the heele but in men it groweth to the 4 extender of the foot,[fig.14,r] in ſomuch that euen to the very heele it cannot be ſeparated there-from. And theſe three muſcles doe draw the heele vpward and backeward, and doe faſten the foote vpon the earth, or reflect it downeward and backward.

The ſecond extender.

The ſecond extender is called *Gaſtrocnemius externus, the outward Calfe-muſcle* [ta. 31,and thoſe that follow.fig.3,4,10,13,14,o] It proceedeth from the vtter head of the thigh, & is in all parts like the former, ſauing that the firſt deſcendeth fleſhy lower, which

Table 35. Sheweth ſome Muſcles of the Thigh, the Legge, the Foote and the Toes.

TABVLA XXXV.



a 10, the ſpine of the haunch-bone bared from the muſcles.
b 10, the greater exteriot proceſſe of the thigh.
a b, 12, the originall of the firſt extender of the thigh at *a*, his tendon at *b*.
e 12, the ſhare-bone bared.
f, 12, the thigh-bone without fleſh.
g 12, the backpart of the whirle-bone regarding the ioynt, the tendons grow to the foreſide.
h 12, the tendon of the ſecond extender of the leg called *Vaſtus externus*.
i 12, the inſertion of the fourth bender of the leg called *Biceps*.
k 12, The connexion into one of the tendons of the 7,8,and 9.muſcles.
l 12, The tendon of the ninth muſcle of the legge called *Rectus*.
m 12, the forepart of the leg bone without fleſh.
n 10, the original of the ſecond bender of the foote.
n 12, the forepart of the *Brace* bared,
o 12, A ligament placed betweene the bone of the leg and the brace.
o 10, the outward anckle.
p q 10, the body of the ſecond bender of the foot before and behind.
r 10, the beginning of the tendon of this muſcle ariſing out of the middeſt of his body.
ſ 10, The tendon of the third bender of the foot reflected to the outward ankle.
γ 10, the originall of the third extender of the leg called *Vaſtus internus*.
δ 10, the fourth bender of the leg called *Biceps*.
θ 10,11,12, the third extender of the leg called *Vaſtus internus*. *ζ* 10, the third extender of the thigh called *Glutæus minor*. *ρ* 10, 11, 12, the firſt muſcle of the thigh called *Triceps*. *σ* 10,11,12, the ſixt muſcle of the thigh called *Lumbalis*. *σ* char. 12, the forepart of the fift muſcle of the thigh. *τ* 10,11,12, the ſeuenth muſcle of the thigh called *Iliacus Internus*. *υ*, 10, 11,12. the eighth muſcle of the thigh. *φ*, 12. The firſt Compaſſer of the thigh called *Obturator externus*. *ω* 10, the ſecond extender of the foote called *Gaſtrocnimius externus*. A 11,12, the holy-bone. H 10, the ſecond extender of the leg called *Vaſtus externus*. M 10,12, the ſecond bender of the foot called *Peroneus primus*. N 10,12, the third bender of the foot called *Peroneus ſecundus*. O 10, the firſt extender of the toes called *Pollicis tenſor*. T 11, the lower abductor of the great toe. V 10, the abductor of the little toe. X 10, the bone of the leg without fleſh, with the ligament which runneth betwixt it and the *Brace*. Y 10,11, the vpper abductor of the toes. Z 10, makes the muſcle called *Crurens*. Ƶ 11,12, the firſt muſcle of the backe called *Quadratus*.

alſo

alſo may bee perceiued before Diſſection in thoſe bodies that are muſculous or fleſhy. This Muſcle not farre from his originall is ioyned with the firſt with fibrous tyes and groweth thereto at the middle of the Leg: [Tab. 13.d] and therefore *Syluius* and *Laurentius* call them *Gemelli* or the *Twinus*.

This Muſcle when it hath formed the outward part of the calfe endeth in a tendon which is ſo mixed with a Tendon of the former that it ſeemeth to bee but one Muſcle to *Columbus* and *Archangelus*, for they haue but one tendon and one implantation, and theſe two together with the fourth doe make the pulpe or calfe of the Leg.

But becauſe in the direction of the Leg thoſe heades are returned backward and ſo compreſſed; leaſt any offence ſhould thereby proceede, each originall hath a ſmall ſide-bone ioyned to it to receiue the violence and abate it in their ſmooth and ſlippery Surface which ſtandeth vp from the ſubſtance of the Muſcles, and doeth regard the ſmooth ſuperficies of the heades of the thigh whereuppon they leane. Theſe Seede-bones alſo doe keepe the Muſcles from attrition and laceration and adde ſtrength vnto them. The ſeede hones.

The third Extender is called *Plantaris* or the Muſcle of the palme or treade [Ta. 33. and thoſe that follow, fig. 7, 14, 16, n] It lurketh in the hamme vnder the former and is very ſlender. It ariſeth with a fleſhy and narrow originall from the outward head of the thigh neare the ioynt, but deſcending obliquely from the externall toward the internall part it is dilated: yet the fleſhy part thereof is ſmall, for preſently vnder the knee it determineth into a very ſlender neruous and exceeding long tendon [fig. 14. 15. 16.p Ta. 31. fig 2. and 4.n] ſo long that among all the round Tendons of the body there is none longer. This Tendon is ſpread ouer the muſcle following, whereto in his progreſſe it is ſtrongly tyed and implanted into the inſide of the heele behinde. Sometimes it groweth broade and by the ſides of the heele is ſpent into the whole skinne of the palme or plant of the foote, as the palme muſcle in the hand. But when this muſcle (as it is with the muſcle of the palme of the hand) is wanting, then his tendon is ſubſtituted by the ſecond bender of the toes. His vſe is to writhe and turne the foote inward. The 3. extender.

The fourth Extender is called *Soleus* or the Muſcle of the Soale. [Tab. 31. and thoſe that follow, fig. 2, 7, 14 16, I] It is the greateſt and the thickeſt Muſcle of the foote and lyeth vnder the former Muſcles, and where the two firſt leane vppon it, it is liuid like them. It ariſeth neruous and ſtrong from the backepart of the *Fibula* or Brace, where it is articulated with the *Tibia* or Leg-bone, and becomming thicker it exceedeth in bredth both the bones of the Leg, but about the middle it is by degrees anguſtated or ſtraytned, and a little aboue the heele degenerateth into a thicke and very ſtrong Tendon, which on the foreſide is nouriſhed or encreaſed with a ſubſtance like fleſh farther then it is on the backſide, and being vnited with the Tendon of the firſt and ſecond Muſcles [Ta. 38. fig. 16 r & I] is implanted very ſtrongly into the backpart of the heele, where for this Muſcles ſake it is depreſſed and rough. His vſe is to extend the foote and firme it vpon the ground. The 4. extender.

But becauſe the bone of the heele ſtandeth out beyond the rectitude of the bone of the Leg, this tendon a little before his inſertion departeth from the legge [fig. 15.*] and maketh an empty cauity, through which the Butchers peirce their Cammockes to hang the beaſt vpon in the ſhambles; for in the whole body there is no Tendon ſtronger then it. *Hippocrates* calleth it *Chorda*, where he ſaith that vppon the fracture of the heele there follow dangerous Agues full of Hiccocks and convulſions.

The fift and laſt Extender is called *Tibiæus poſticus*, the hinder Leg-muſcle. [Ta. 31. fig. 2, 7, 18, 19, K] It lyeth next to the bone betwixt the *Brace* and the *Legge* vnder two Muſcles which bend the Toes. The 5. extender.

It ariſeth from the two foreſaid bones [fig. 18, l] and preſently becommeth fleſhy and broade, deſcending fleſhy vnto the extreame appendix of the *Legge*, vppon which bone for the moſt part it lyeth through his length: it cleaueth alſo to a Ligament which lyeth betwixt theſe two bones, from whence haply his originall gathereth ſtrength; and in the middle of the *Leg-bone* from the inſide only it produceth a round neruous and ſtrong Tendon which tooke his beginning a little within the ſubſtance of the Muſcle. This tendon creepeth through a cauity grauen in the Leg-bone neare the inner ankle; vnder the tranſuerſe Ligament and obliquely attayneth vnto the ſoale of the Foote vnder the Muſcles which occupy the plant [Ta. 36, fig, 18, 19.m] or Treade, and is ſtrongly inſerted into the proceſſe which is on the lower ſide of the bone of the *Tarſus* or After-wreſt of the foote which is neare the Cube-bone, which proceſſe was onely created for his inſertion.

His

His vſe is to draw the foot inward, it helpeth alſo the motions of the firſt, ſecond & fourth Muſcles, and therefore moueth the foot to the earth, and ſometimes leadeth it backward, when we would ſtand vpon our tip-toes as we ſay. And thus much concerning the extending Muſcles of the foote on the backpart thereof. It followeth that we ſhould intreat of his bending or *anterior* muſcles which we ſayd are three.

The1 bender

The firſt Bender is called *Tibiæus anticus*, the foreward Leg-muſcle, [Ta. 31. and thoſe that follow, fig. 1,7,8,L] becauſe it cleaueth to the forpart of the Leg-bone at his outſide.

It is the larger of the Benders and very nearly reſembleth a Snake and lyeth vppon the Muſcles of the Toes: It ariſeth acute or ſharpe neare to the *Brace* where it is articulated with the Leg-bone. Preſently it is dilated, and on the inſide of the Leg-bone it is ioyned to an acute line and becõing ſtreighter by degrees vnto the middle of the leg-bone determineth farre aboue the foote into a round, neruous and ſtrong tendon [fig. 2. and 18. n] which tendon alſo ſometime riſeth vp vnder the skinne, and growing from the lower appendix of the leg and the brace vnder the tranſuerſe ligament attaineth to the inſide of the foot, and couuayed in a reaſonable open cauity aboue the vpper part of the After-wriſt or the *Tarſus*, is wholly inſerted into the inner proceſſe of tha, bone of the wreſt of the foote which ſuſtayneth the great toe. His vſe is to bend the foote it ſelfe, and to draw it forward and vpward. This muſcle as alſo that that went before, eſpecially in that part where they are reflected vnder the wriſt and After-wriſt of the foote, haue a griſtle and ſeede bone allowed them by Nature to preuent their attrition.

The2. bender

The ſecond bender called *Peronæus primus*, or the *firſt brace muſcle*, [tab. 31. and thoſe that follow fig. 1. 3. 8. 9. 10. 11. 16. 18. 19. M] is in his whole progreſſe ioyned with the outſide of the precedent muſckle, and by it ſelfe is repreſſed in the outtſide of the leg. It ariſeth fleſhy and neruous [fig. 10. n] from the vpper and outward part of the appendix of the *fibula* or *brace*, and becomming fleſhy it paceth along the ſame, cleauing ſom part to his ſide: departing from the *brace* it is on the outſide liuid, but on the inſide fleſhy and ruddy, and being conuayed a litle below the middle of the *brace* between two fleſhy ſides [fig. 10. p q] out of the very middle of his body produceth an exceeding ſtrong tendon [fig. 10. r] which is increaſed in the inſide on either hand with fleſh; which tendon becomming by degrees without fleſh, and reflected obliquely toward the backeſide of the appendix of the brace, and leauing the outward ankle naked [fig. 10. o.] beeing inuolued in a tranſuerſe ligament which proceedeth from the brace into the heel and the bone called the *cockall* or the *talus*, it paſſeth the fiſſure of the ſame outward ankle, and being very much reflected vnder the *plant* [tab. 36. fig. 19. tu] is inſerted brode into the root of that bone of the wriſt of the foote which lyeth vnder the great toe. I ſay into the proceſſe which is on the outſide of that bone: ſometime into that bone vpon which the middle toe reſteth.

His vſe is to leade and bend the foote upward and outward. But this tendon paſſeth in the middeſt betwixt the bones and the muſcles of the plant or ſole of the foote [fig. 19. tu] leaſt if it ſhould walke onely vnder the skinne when it is contracted vpward it might compreſſe the muſcles ſeated in the ſoale and hinder their functions. So alſo in the lower part of the *cube-bone*, there is a cauity ſomewhat brode but not deepe, ſmeared ouer with a viſcide humor and compaſſed with a ſlippery ligament, at which the tendon is compaſſed not round leſt it ſhould fall thereout, but dilated [tab. 36. fig. 19, t] that ſo it might more firmely be reuolued at the ſhallow cauity. Againe the tendon in the ſame place is ſo hardened that it is like a gryſtle, yea ſometime ſo bony as if it were a ſeede bone, that it might better and more readily auoyde the violence of the bending or flexion at an acute angle.

The third.

The third and laſt bender called *Peroneus ſecundus*, the ſecond *brace muſcle*, [Tab. 31. and thoſe that follow fig. 3, 8, 9, 10, 18, 19. N] is hid vnder the former (his tendon excepted) and is like thereto. It ariſeth alſo with a long originall from the ſame appendix of the brace, and being fleſhy deſcendeth downe the ſame brace to which it is tyed, and when it hath ouercome the middeſt thereof, it departeth into a round tendon which is reflected toward the backeſide of the brace and is faſtened to the foreſide of the tendon of the ſecond bender, and lying vpon a cauity ingrauen in the backeſide of the appendix of the brace and compaſſed with the tranſuerſe ligament it deſcendeth forward: but at the vtter and lower part of the ankle it is againe reflected, deuided, and becommethforked, [tab. 35. fig. 10. ſ.] leſt it ſhould bunch vp too high and is implanted [tab. 36. fig. 19. x.] very

ſtrongly

strongly with a double and broad insertion into the processe of that maner bone of the wrist of the foot which sustains the litle toe. His vse is to leade and bend the foot outward.

To these eight muscles of the foote *Vesalius* and *Falopius* add a ninth [Tab. 33. fig. 8. 9. p.] which *Bauhine* taketh rather to be a part of the second extender of the toes [ta. 33 fig. 7,8,9. P.] then a particular muscle of it selfe. And thus much of the muscles of the foot. *Falopius* ninth muscle.

CHAP. XL. *Of the muscles of the Toes.*

THe foure toes of the foote are moued almost with the same motions that the fingers of the hands are mooued with. But the great or thumbe-toe is not led after the same maner with the thumb of the hand, that is, with a flexion opposit to the other fingers, but his first ioynt is bent after the same manner with the first ioynts of the rest of the toes, because his position is in the same order. The toes therefore are moued directly or sidelong. If directly, then either they are bent toward the earth, euery ioynt being mooued apart, and that either directly onely, as the second and third ioynts of the foure toes, and the second of the thumbe or great toe; or directly & obliquely together, as the first ioynts of all the fiue toes. If they be extended, the extention is made directly or in a right line, and so all the ioynts are moued together. If they moue to one side that motion is eyther outward, as when the foure greater are led to the little toe, and the little toe led from the rest: or inwarde when the thumbe-toe is ledde from the rest and the foure lesser toes moued toward it. All these motions are absolued by three and twenty muscles, whereof some are seated in the leg, that is to say, part in his fore part & part in his backpart. Others are placed in the foote it selfe, properly so called. The motion of the toes. Their muscles 23.

The first muscle of the toes is called *Pollicis tensor, the extender of the great toe or the first extender*, [Tab. 33, fig. 8,9,°] It is seated in the forside of the legge, together with that which next followeth at whose inner side it lyeth. First.

It ariseth fleshy from the outside of the legge where the bone of the leg or the *Tibia* departeth from the *Brace* or the *Fibula*. After it descendeth and groweth in his whole passage to a membranous ligament which commeth betwixt the leg & the Brace bones and so attaineth vnto the foreside of the leg; thence creeping vnder the transuerse ligament [Tab. 31, fig. 1, char. 2] and ouer the foote, it is inserted into the vpper part of the whole length of the great toe to extend it. Sometimes the tendon is diuided into two, one of which is inserted into the last ioynt of the great toe, the other into the wrist of the foote to bend it. And this latter tendon in some bodies seemeth to be a distinct muscle. But that saith *Columbus* is very rare.

The second extender [Tab. 31, and those that follow fig. 1,3,7,8,9, P] is placed in the forepart of the leg, but lurketh vnder the sixt muscle of the foote. It ariseth with an acute and neruous originall [Tab. 33, fig. 8, char. 10.] which presently becommeth fleshy, from the top or extremity of the appendix of the leg, where vnder the knee it is fastened to the Brace; thence it descendeth directly along the Brace and about the middle thereof it casteth off from his outside a fleshy portion, [tab. 31, & those that follow fig. 8. 9, P] which portion descending downeward, maketh that muscle which *Fallopius* calleth the ninth muscle of the foote: presently falling yet lower vnder the transuerse ligament which is on the foreside of the leg, [tab. 31, fig. 1, char. 2,] to which it adhereth; at the end of the *Fibula* or *Brace* it degenerateth into a tendon, [tab. 33, fig. 8, charact. 12,] which tendon before it passe the transuerse ligament is diuided into foure round tendons separated & conueyed through the backe of the soale vnto the foure toes, (beside the great toe) which run through their whole length, and becomming broader are inserted into their vpper parts. Their vse is to extend the three ioynts of the foure toes together. Second. Fleshy parts.

The third muscle of the toes is called *Pollicis Flexor, the bender of the great toe, or the first bender*, [ta. 31, and those that follow, fig. 2,7,16,17,°] and is seated with that which next followeth in the backpart of the leg vnder the muscles, which make the *Pulp* or *Calfe*, and it is almost altogether fleshy. Third.

It ariseth [figure 16, character 13,] from the backe-part at the connexion or conjunction of the *Brace* with the Legge-bone, and growing for a time to the *Brace*, it approcheth to the ende of the Legge-bone, where from his inside there issueth a rounde Tendon, [figure 16,17, character 14,] which may bee seene manifestly to haue his originall out of the flesh, [Table 36, figure 16, ω] which tendon passeth obliquely vnder the Ankle at the inside of the heele, where a cauity is engrauen for it, and

where alſo it is couered with a tranſuerſe ligament: thence it inclineth vnder the plant or treade of the foote, at which place ſometimes it tranſmitteth certaine ſmall portions into the tendons of the third muſcle with which it is commixed, [fig.16,cha.19] and when his eſpeciall tendon is receiued by the tranſuerſe ligament, it is inſerted with a broade implantation into the ſecond bone of the great toe after it hath paſſed the length of the firſt, which ſecond bone it bendeth. Sometime vnder the ſoale it is diuided into two tendons the larger wherof it tranſmitteth to the great toe; the leſſer vnto the next, and then the ſecond bender is diuided onely into three tendons and no more. This tendon before it is inſerted into the ſecond bone of the great toe hath a great ſeede-bone ſet before it with a ſlippery and ſmooth ſurface.

The fourth. The fourth Muſcle of the Toes or the ſecond Bender which is called *Digitorum flexor magnus*, the great Bender of the Toes [tab.36.fig.16,17,18,R] lyeth neare the former and leaneth rather vpon the Legge then vpon the Brace-bone [table. 36.fig.18, rather A then B.]

It ariſeth fleſhy from the Leg-bone vnder the hamme [fig,16.cha.8] and deſcending almoſt to the heele, it produceth from the inſide a round tendon [fig,16.char.7.] which paſſing along vnder the inner ankle, and in a peculiar cauity of the heele [fig,19,P] and vnder the tranſuerſe Ligament which groweth from the appendixe of the Legge, it runneth vnder the tendon of the third Muſcle in the ſoale of the Foote with which it maketh a decuſſation [fig.17.betwixt the 17, and the 15, characters] and in the middle of the foot is deuided into foure tendons, [fig.17,char.18.] which being bound with Ligaments and paſſing through the Section or diuiſion of the Tendons of the ſubſequent muſcle are inſerted broade according to the length of the bone into the third ioynt of the foure Toes. The vſe of this Muſcle is to bend thoſe foure toes, to contract them ſtrongly and to lead them one to another.

The fift. The fift Muſcle is alſo the third bender. [ta.36.fig,16,17.S] It is ſeated vnder the middle of the ſoale and ariſeth with an originall mixed betwixt a neruous and a fleſhy from the lower part of the heele-bone, and the forepart of his protuberation. Preſently after his originall it becommeth fleſhy and paſſeth toward the Toes, being by degrees dilated or ſpread abroad according to the forme of the foote. At the middeſt whereof it is deuided into foure fleſhy parts; [ta.36.fig.16.char.21.] which parts being ſeparated doe each of them produce a round tendon which are receiued at the roote of the firſt ioynt by the tranſuerſe Ligament, and being deuided (as it is in the hand) with a long ſection each of them growing broade, are inſerted into the ſecond bone of the foure Toes.

The vſe of this Muſcle is to bend the ſecond ioynt of the foure Toes. There alſo groweth very ſtrongly a broade tendon [ta.34.fig.15.ζ] vnder all the fleſhy ſubſtance of this Muſcle, which ſerueth inſteade of the broade tendon of the hand, and ſometimes is the tendon of the third muſcle of the Foote which is called *Plantaris*. This tendon is of exquiſite ſenſe the better to forwarne vs vppon the inſtant of externall iniuries.

[*Table 36.is the ſame with* 31.*Folio* 806.]

The ſixt or The ſixt Muſcle is called *Abductor pollicis inferior*, the lower backe-leader of the great Toe. [tab.31.and thoſe that follow, fig,1,2.7,11,16,S] It lyeth to the inſide of the Foote throughout the length thereof, and reſembleth the faſhion of a Mouſe. His originall is neruous from the heele on the inſide neare the muſcle foregoing, and becomming fleſhy it is faſtned to that bone of the wreſt of the Foote which ſupporteth the great Toe, & degenerateth into a round tendon which is implanted on the outſide into the firſt bone of the ſaid great Toe to lead it from the reſt.

The ſeauenth The ſeauenth Muſcle is called *Abductor minimi digiti inferior*, the lower back-leader of the Little Toe. [tab.31.and thoſe that follow, fig.3,4,15,16.V] It is ſituated in the externall part of the Foote and ariſeth with a neruous originall from the vtter part of the Heele where there is a protuberation, and becomming fleſhy it expreſſeth the forme of a perfect Muſcle, and is affixed to that proceſſe of the wreſt-bone which ſuſtaineth the little Toe, and determineth into a round Tendon which is infixed into the outſide of the firſt bone of the little Toe to lead it from the reſt.

Theſe three are couered or inueſted by a thicke and broade tendon as it was in the palme of the hand.

The 8.9.10. & 11. The 8.9.10. and 11. Muſcles, or the 3.4.5. and 6. Extenders, called alſo *Lumbricales*, the

Table 38. sheweth the Muscles of the Foote and the Toes thereof. But the 18. the 19. Figures shew the right Foote as did those two in the 34. Table, but here it is more bared from the Muscles.

TABVLA XXXVIII.

FIG. XVI

FIG. XIIX.

FIG. XIX.

FIG. XVII.

FIG. XX.

a 16, The backe of the hanch bone bare.
b 16. A membranous ligament occupying the greate perforation of the sharebone.
l m 18. The beginning of the fift extender of the Foote at *l*, his tendon at *m* 18, & 19.
n 18. A portion of the Tendon of the first bender of the foot.
p 16, The tendon of the 3. muscle extending the foote.
t u 19. the 2. bender of the foot or the first *Peroneus* reflected in the foote.
x x 16. two fleshy partes compassing the Tendons of the tenth muscle of the thigh.
x 19. The insertion of the 3. bender of the foote.
A 18, 19, The bone of the leg.
B 18, 19. the *Brace*.
C D 18, The bosome or cauity of the tendons of the 2, and 3 muscle of the toes
E 18, Small bones neare the first ioynt of the great toe.
F 19. a ligamēt going betwixt the bones of the leg and the *Brace*.
H 16, the 3, extender of the Foote called *Plantaris*. I 16. the 4. extender of the foote called *Soleus*. K 18, 19, the fift extender of the foote called *Tibiaus posticus*. M 16, 18, 19. the 2, bender of the foote or the first *Peroneus*. N 18, 19. the 3, bender of the foot or the second *Peroneus*. Q 16, 17, 18, the first muscle bending the toes of the foote or the bender of the great toe. R 16, 17, the second bender of the toes or their great bender. S 16, 17, the 3 muscle bending the toes or their other bender. T 16. the lower *abductor* of the great toe. V 16, the *abductor* of the little toe. *X* 17, 18, the foure muscles called *Lumbricales*. *Z* 16, the muscles called *Interossei* or the bone bound muscles. λ 16, the muscle mouing the Leg obliquely called *Popliteus*. *c* 16, the first bender of the thigh called *Lumbalis descendens*. *r* 16, the 2, bender of the thigh called *Illiacus internus*. φ 16, a portion of the first compasser of the thigh. ϕ 16, the first extender of the foot called *Gastrocnimius internus*. ω 16, the second extender of the foote called *Gastrocnimius externus*. * 16, the thigh bone bare. 1, 2, 3, Char. 19, three *Sinus* or bosomes made to carry three tendons. 3, char. 16 a ligament hanging from the ioynts of the Toes, doing the office of the broad tendon. 4, 5, char. 16, the originall of the muscle of the ham called *Poplitaus* at 4, his insertion at 5. 13, char, 16, the originall of the first bender of the toes. 14, 15, char, 16, 17, the tendon of that muscle at 14, his insertion at the great Toe 15. 16, char, 16, the beginning of the second bender of the toes. 17, cha, 16, 17, the tendon of the same arising there. 18, char, 17, the tendon deuided into foure parts. 19, char, 18, the commixtion of the tendons. 20, 21, char, 16, the third bender of the toes, his originall from the heele at 20, his diuision into foure tendons at 21. 22, char, 16, 17, 18, a fleshy portion growing to the bones of the foote at the great toe.

Figure 20, sheweth the Ligaments growing to the ioynts and the Bones of the Leg & the Thigh.

A B, The thigh bone at A his vpper head at B. C D, the 2 lower heads thereof. E, the bone of the leg. F, his vpper protuberation. G, the lower *sinus* or cauity. H, the inner ankle. I, the *Brace-bone* called *Fibula*. K, the vtter ankle. L the vpper, a round ligament of the head of the thigh. L the lower, a muscle in the calfe or the fourth of the foote. M M, a ligament compassing the vpper ioynt of the thigh. N, A ligament growing to the greater processe of the thigh. O, A Ligament affixed to the lesser processe of the thigh. P P, a ligament involuing the ioynt of the knee. Q R, a ligament set to the vtter and inner side of the knee. S, a ligament coupling the protuberation of the leg-bone marked with F and the thigh together. T V, a ligament binding the leg-bone and the *Brace* together aboue and below. *X*, a membranous ligament fastning together the Leg and the *Brace*. Y Z, a transuerse ligament gathering the neruues. α a tendon made of three muscles of the foote and inserted into the heele. *a b*, ligaments ioyning the heele to the *Leg* and the *Brace*: from the bone of the leg to the heele at *a* from the *Brace* to the heele at *b*. *c d*, A gristly Ligament running from the inner Ankle into the inside of the *Talus* at *c*: another ioyning the *Brace* to the *Talus*.

the wormy Muſcles [tab.36.figu.17,18,x] are ſeated vnder the ſoale of the Foote, and ariſing from the Ligament which compaſſeth the foure tendons of the perforating Muſcle or the ſecond Bender, are implanted round and ſmall into the Tendons of the Muſcle extending the Toes, to extend or ſtreatch forth their ſecond or third ioynts. Theſe Muſcles for their farther ſtrength receiue a fleſhy portion from the heele, which lyeth vnder the three forenamed Muſcles.

The twelfth

The twelfth Muſcle called *Abductor digitorum ſuperior*, the vpper backe-leader of the Toes, [tab.31.fig.1,8,9,10,11,TY] is ſeated in the vpper and gibbous part of the Foote. It is a broade and ſlender muſcle, and ariſeth fleſhy from the Ligaments which are at the heele and the bone called *Cubiforme* or the Dye aboue the wriſt and After-wriſt of the Foote, and running obliquely toward the toes is diuided into foure fleſhy parts euery one of which make a round tendon. The greateſt of which is inſerted in the vtter ſide of the great toe toward the height thereof. The ſecond of the next toe. The third of the middle toe, and the fourth of the fourth toe. Sometimes alſo but rarely a ſmall part is lent vnto the little toe.

The vſe of this muſcle is to moue the toes to the ſides and to leade them backward & outward. But when it hath onely foure tendons, then the tendon belonging to the little toe ariſeth from the third externall muſcle of the foote although the lower backe-leader of the little toe or the ſeauenth muſcle will ſerue that turne.

The thirteenth

The thirteenth muſcle ariſeth with a broade and neruous original from the ligament of the firſt ioynt of the little toe, ſometime of the toe next vnto it, afterward becomming fleſhy, it paſſeth thwart ouer the firſt ioynts of the toes and determineth in a broade but ſhort tendon which is inſerted a little inward into the firſt ioynt of the great toe.

The vſe of this muſcle is double, firſt that when it worketh wee may better hold our feete as we ſay in vnequall places, for it maketh a kinde of apprehenſion. The ſecond that when it worketh not, it might ſerue the foote in ſtead of a ligament, leaſt when wee walke vppon euen ground, the ſoale of the foote ſhould be enlarged beyond that that is fit, and ſo the toes led one from another. Concerning this muſcle ſaith *Bauhine*, *Iulius Caſſerius* firſt writ vnto me.

Caſſerius.

The ten muſcles betwixt the bones.

Vnder this muſcle lye the ten muſcles called *Interoſſei* or the *bone-bound* muſcles (for you muſt giue vs leaue to make engliſh words as our Authors haue done in greeke and latine) [tab.36,fig.18,19,*] which are to be referred to the benders of the toes. Theſe haue their ſituation in the ſoale of the foote where they make a rude and indigeſted lump of fleſh diuerſified with right fibres, which lumpe proceedeth from the beginning of the after-wreſt, and paſsing throughout his length fill vp the ſpaces betweene the bones and are inſerted two and two into the rootes of all fiue toes or at the ligament of the firſt ioynt toward the inſide, that ſo when two worke together, they may bend the firſt ioynt, but when one alone worketh, it leadeth the ſame ioynt to the ſide eyther outward or inward as the ſite and originall of the muſcle is. To the ſhort and broade tendons of theſe muſcles do grow for their further ſtrength ſeed-bones, ſuch as are in the hands, but greater.

The concluſion of the muſcles.

And thus haue we brought to an end this crooked and crabbed hiſtory of the muſcles cõcerning which, I know not whether I ſhould rather craue pardon or pitty, pardon I preſume I ſhall not neede to craue of them that vnderſtand through what a laborinth I haue led my pen: pitty alſo will do me little good now the paine is paſt. Acceptance ſhall bee better welcome then eyther, and an ingenious mind that meaſureth my foote by his own Laſt. One other paſſage remaineth in this booke, and that is concerning thoſe other kindes of fleſh which are found in the body of man, to wit, the fleſh of the *viſcera* or *Entrals* and that of the Glandules, which two when we haue lightly paſſed ouer, we will proceede vnto the booke of the Veſſels.

CHAP. XLI. *Of the fleſh of the Entrales or Bowels.*

Parenchyma what it is.

Galen eſteemed the fleſh of the Bowels to be ſimilar and ſimple, not onely in reſpect of the miſtion, becauſe all euen their leaſt particles are of one and the like nature, whence ſome Arabians haue called it *Confuſa*. *Eraſiſtratus* called it firſt of al men παρεγχυμα as it were an affuſion or cocretion of blood. This fleſh *Eraſiſtratus* eſteemed to haue no other vſe but only to ſeparate the veſſels and to ſerue as a ſoft cuſhion or pillow for them to reſt on, and to ſtrengthen and eſtabliſh their paſſage, but we eſteeme it to be of a great deale more excellent vſe, for wee thinke

thinke that it is the chiefe part of the bowell to which the officiall or common action thereof primarily appertaineth. So Sanguification primarily and of it selfe belongeth to the Flesh of the Liuer; to the veines secondarily onely and by influence. His excelencie.

The Flesh of the Longues prepareth the aire for the Heart, the Flesh of the Spleene purgeth the Lees or fœculencie of the bloud, the Flesh of the Kidneies draweth and separateth the whey or vrine. Wherefore this Flesh maketh the proper substance of the bowell or entrall. Onely this among all sorts of Flesh is insensible, and according to *Galens* testimony *in Arte parua* is of the number of those partes which haue their faculties seated and established in them not influent or deriued from other parts.

The Flesh of the Liuer is red and moderately thicke, neither doeth the heate thereof alone further the sanguification of the veines, as the Kell, the Spleen and the parts thereabouts doe assist the concoction of a Stomacke: But by an in-bred and proper power it sealeth or imprinteth vpon the bloud his stampe or forme his temper and colour. Of the Liuer.

The Flesh of the Spleene is a rare spongy or funguous *Parenchyma*, loose like the faster sort of sponges, and fit to draw and receiue muddie and melancholique humors. Of the spleen

The Flesh of the Kidneies is red, fast and solid, differing not much from the substance of the Heart, sauing that it is not intertexed or wouen with fibres. It was made solid, least if it had beene loose and flaccid it should not haue beene able to containe the vrine that it receiued. It draweth by an inbred power whey or vrine from the whole body, separateth it being mingled with the bloud, and transfuseth it drop by droppe into membranous cauities. Of the Kidneies.

The Flesh of the Longues is light, rare and like vnto a sponge, made as it were of the froth of bloud congealed together. It is light that it might easily be lifted vp, and fall againe without violence, and so readily obey or follow the motions of the Chest. It is rare and spongy that like a paire of bellowes it might presently be filled with the ayre we breath in, as also to make the way fit for the breathing out of sooty and smoaky vapours. This Flesh prepareth for the Heart one of the materials of the vitall spirit, that is ayre, for the outward ayre which hath much impurity mixed therewith, could not at the first hand be made a fit nourishment for the inward spirit, & therefore it was necessary that it should be altered by littleand little, and by some stay made in the Lungs, acquire or attaine a quality familiar to the inbred spirit. Of the Lungs

Concerning the flesh of the heart, it may be doubted whether it ought to be referred to the flesh of the bowels or to the flesh of the Muscles: *Galen* holdeth on neither side; for a *Parenchyma* hath no fibres, the Heart is wouen with them after a strange and admirable manner. Againe, the motions of the Muscles are Voluntary, so is not the motion of the Heart. The Flesh therefore of the Heart is peculiar to it selfe alone, such as you cannot finde in the whole body againe. Of the heart.

There is no lesse scruple also concerning the Flesh of the Tongue, for it is as nimble as an Eele; turning it selfe into a thousand motions, yet are there no fibres running therethrough, and therefore the Flesh thereof cannot be sayde to bee musculous, rather if all things be considered it inclineth to the nature of a *Parenchyma*. And so much shall be sufficient to haue said concerning the Flesh of the Bowels or Entrals.

CHAP. XLII. *What a Glandule is, and how many kinds there be of them.*

BEcause many of the Ancients haue defined a Glandule to bee a *Flesh rowled vp into it selfe*: I haue thought fit sayth *Laurentius* for order sake to refer the whole kinde or kin of Glandules vnto Flesh. What a glandule is.

A Glandule therefore which the Græcians call ἀδὴν is a simple part, Rare and fryable, soft like a sponge, appoynted by Nature to firme and establish the vesselles, to sucke or drinke vp superfluous humours, and to water or dew some partes that stoode need of moysture.

The Author of the Booke *de Glandulis*, whether it were *Hippocrates* or *Polybius*, hath elegantly expressed the nature of a Glandule, where hee sayeth *Their Nature is spongy for they are rare and fat.* That they are of such a nature you shall easily find if you presse them hard betwixt your Fingers, for they will yeilde an oylie humour and bloud, white like phlegme. Now it is consonant to reason that they haue such a substance, not for nought but for some particular and especiall vse. That vse is three-fold.

The first vse of glandules.

The first vse of the Glandules is to firme or establish the diuarications or diuisions of the vessels. For it was to be feared least the vessels running through large and ample cauities, if they had no other muniment or defence sauing their owne membranes, would in violent motions be broken off, as in great windes boughes are torne from a tree; vnlesse these glandulous bodies did lye soft vnder them and establish and sustaine them. And therefore where the vessells are forcked or deuided, there Nature hath euer placed Glandules vnder them.

So in the diuision of the Gate-veine there is a notable Glandule called *Pancreas* or the Sweete-bread. In the diuarications of the veines of the Mesentery there are Glandules almost infinite. In the distribution of the ascending trunke of the hollow veine is the glandule called *Thymus* which is the sweetebread in calues. In the vessels of the braine the glandule called *Conarium* or the pine-glandule. In the the necke, in the arme pits and in the groynes where the *Iugular axillary* and crurall veins are diuided there are glandules placed to support their diuisions. VVherefore they were made soft and rare, that neyther their hardnesse might offend the vessels, and by yeelding they might giue way to the distentions when they strut with blood.

Their second vse.

The second vse of the glandules is like sponges to sucke and drinke vp fleame, whey and other superuacuous humours, that they should not rush vpon the more noble parts. In which respect their forme is round, somewhat long, and their substance rare and open; so fitted to receiue the greater quantity of any kind of influxion. This vse the authour of the booke *de glandulis* openeth vnto vs in these words. They beare away the redundancie or surplussage of the rest of the body, and that indeede is their familiar Element. It may also by reason be demonstrated that they were ordayned by nature to purge away moyst superfluities; for those parts that are hollow, and especially if they bee moyst and full of blood, haue more and larger glandules then those that are solide and lesse succulent, as are the ioynts. So behind the eares about the necke where the iugular veines run, about the arme pit where the axillary branch is, and about the groynes where the crurall veine appeareth, there are notable glandules which receiue the superfluities of the principall parts, the Brayne, the Heart and the Liuer, which glandules are commonly called *Emunctories*, and if they swell or bee otherwise affected, they betoken the distemper of their owne bowell or some ill disposition therein. *Hippocrates* in the second section of his 6. booke *Epidemion*, saith *Abscesses* or *Apostemes* (as for example the tumors of the glandules) are produced as fruiteless water shootes of those places, out of which they grow. They also bewray the condition of other places and parts, and especially of the bowels. *Galen* also in the thirteenth booke of his Methode saith, that when an Apostemation ariseth neare any notable artery or vein sudainly do spring vp *Bubones*, that is, inflammations of the glandules.

The thirc vse.

Thirdly we added in the definition, that the vse of the glandules was to irrigate or water some parts lest they should too easily bee exiccated and dryed or made vnfit for motion. Such are some of the glandules of the Mesentery, which with their moysture do dew the guts. Such are also the glandules of the Throttle or the Tongue, which ingender or gather spittle. The glandules in the corners of the Eyes doe make much toward the celerity and ease their motions, and finally those prostate glandules in the neck of the bladder doe water and moysten the Vreter with an oyly humidity, lest it should bee offended by the Acrimony of the vrine. And this is the nature of glandules properly so called.

Glandulous bodyes.

There is also another kinde of glandules which may more truly be called *Glandulous bodyes*. Their substance indeed is like vnto a glandule that is rare and lax, but it is ordayned by Nature for the generation of humours or iuyces which are profitable for the creature. Proper or simple glandules haue neither peculiar veines, nor arteries, nor nerues And according to *Galen*, they are in the last of those parts which haue faculties inbred & seated in them, not flowing from otherwhere: but these glandulous bodyes haue manifest and conspicuous vessels, and are also of exquisite sense. The former haue onely an vse in the body: these latter haue not onely an vse, but doe also performe an action. So in *Galen* the Testicles are called glandulous bodyes: for their substance is soft and hollow, in which the seede is boyled and perfected. So the dugs are glandulous bodyes and haue a power or faculty in them for the generation of milke. Notwithstanding these glandulous bodyes doe sometimes affoord the same vse that the other glandules doe, that is, to sucke or sup vp the recrements or excrements of the whole body: for Nature doth often abuse

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one and the ſame part to diuers vſes. So *Hippocrates* reckoneth the Kidneyes in the number of the Glandules, yea and the braine it ſelfe *is like vnto a Glandule, for it is white and friable* and performeth the offices of a Glandule to the head.

CHAP. XLIII. *A briefe enumeration of the Glandules in the whole body.*

THE number of the Glandules is almoſt infinite, we will onely run ouer the moſt notable, and of them giue you but a light view, becauſe you haue heard their particular deſcriptions in their proper places.

In the braine there are 2 Glandules not very great indeed but very notable. The firſt is of a turbinated figure commonly compared to a pine-kernell and called *Conarium*; of which you ſhall reade in the twelfth chap. of our ſeauenth booke. It is thought to be ordained for an eſtabliſhment vnto the veines and arteries which are diſperſed into the braine, and maketh the way open for the Animall ſpirit out of the thirde into the fourth ventricle. The other is called *Glans Pituitaria*, the phlegmaticke Glandule; of which you ſhall reade in the thirteenth chapter of our ſeauenth booke. The glãdules in the braine.

His porous or open fleſh like a ſponge receiueth the ſuperfluities of the vpper ventricles of the braine, and diſtilleth them into the Pallate through the holes of the wedge-bone. Vnder the eares and behind them there are many glandules called Parotides appointed to eſtabliſh the diuiſions of the veſſels, and to drink vp the humors of the braine, whoſe Emunctories they are commonly ſtiled. Betwixt the skinne and the fleſhy membrane of the Face there are many glandules, ſayth *Platerus*, which they call Animelles: as alſo betwixt the lower ſide of the puffe of the cheeke, and the beginning of the necke, where the Kings euill doth often ariſe.

In the inſide of the chops which from the narrownes is called *Iſthmus*, there do appeare two glandules like blanched Almonds, and therefore they are called the Almonds of the throate and Tonſillæ, and theſe do perpetually moyſten the chops, the mouth, and the tongue with ſpittle. There are alſo two at the roote of the Larinx or throttle, and two vnder the gullet, which often-times do ſo ſwell that they interclude the way both of meate and drinke: but of drinke eſpecially, for the ſolid meate makes it ſelfe a way by cõpreſsion, wheras that which is liquid doth rather fil the fungous ſubſtance of the glandule. The glãdules of the Larinx.

Vnder the top of the breſt-bone, in the very diuiſion of the aſcending trunke of the hollow veine there is a glandule called *Thymus* a lecker or ſweete-bit for nice pallats, made to eſtabliſh the veſſels.

There are alſo many others in the cauity of the cheſt, in the arme-pits, in the groynes, in the armes and in the legs. All which want proper names.

Vnder the Stomacke and the Gut called *Duodenum*, there is a glandulous body, which becauſe it reſembleth a ſimple fleſh, they call *Pancreas*, whoſe vſe is to ſuſtaine, imbrace and comprehend the branches of the Gate-veine, which are to be diſtributed into the ſtomacke, the gut *Duodenum* and the Spleene, which are onely ſupported by the lower membrane of the Kell.

In the Meſſentery there are many Glandules as well to diſtinguiſh the veſſels as to keepe them from compreſsion, when the guts are ouer-filled or when the *Abdomen* is too much ſtrained, for otherwiſe the tranſcolation of the chylus would be hindered. Theſe Glandules alſo do moyſten the guts, and tye as it were the veſſels together that in violent motions they might not bee broken. In the necke of the bladder neare the ſphincter muſcle are thoſe glandules which are called *Proſtatæ*, of whoſe vſe we haue ſpoken partly in the fourth booke, and partly in the former chapter.

The Glandulous bodies we neede not in this place ſo much as to rehearſe for their deſcriptions are large enough in their proper places; whereto we referre the Reader, and heere put an end to our booke of Fleſh: and proceede vnto the Veſſels.

The end of the tenth booke.

THE ELEAVENTH BOOKE,
Of the Veſſels vvhich hath three parts :

The firſt of the Veines.
The ſecond of the Arteries.
The third of the Sinewes.

The Præface.

AS in the Heauens the Angels are the Meſſengers of God, carrying down his commandements vnto men whome alſo they guard and defend; ſo in this *Microcoſme* the dull Fleſh being of too ſlow a kind to enſue the noble motions of the Soule, which with his counterpoiſe it oftner doth oppreſſe, our wiſe Creator ordained ſpirites of a middle Nature betweene the Soule and the Body, which like quicke Poſtes, like Purſeuants or Heralds might tra uell betweene them, and communicate their commiſsion to the particular partes which they receiue either at the firſt hand from the Soule it ſelfe in the Brayne, or haue it ſealed in the Heart or the Liuer, as in her ſubordinate offices.

Theſe Spirits *Galen* calleth ἐνορμώσια Impetuous bodies, becauſe their motion is ſudden & momentanie like the lightning, which in the twinkling of an eye ſhooteth through the whole cope of Heauen; yea ſo much more ſubtle are they then the Lightning, as that the one is viſible the other inuiſible: or they are like the winde which whiskes about in euery corner and turnes the heauy faile of a Wind-mill, yet can we not ſee that which tranſports it. How neceſſary therefore was it that ſuch ſubtle and vndertaking or actiue Creatures ſhould be confined as well to guide their motion which otherwiſe would be inordinate, as alſo to keepe them from exhaling or vaniſhing away. Nature therefore becauſe the Spirites are of three ſorts, Naturall, Vitall and Animall, hath prepared three kindes of Veſſelles for their tranſportation, Veines, Arteries and Sinewes. The Veines becauſe their gueſt is not ſo ſubtile but a more cloudy and thick ſpirit, generated immediately out of the purer ſubſtance of the bloud, haue but a ſingle coate, as being ſufficient to conteine a more quiet ſpirit. The Arteries becauſe their ſpirits are more ſprightfull and impetuous, mouing alwayes with a ſubſultation, and perpetually playing vp & down, are made as ſome thinke ſixe fould as thicke as the Veines, the ſafer to immure the vnruly Inmate. The Nerues are nothing elſe but productions of the marrowy and ſlimy ſubſtance of the Brayne, through which the Animall ſpirits do rather Beame then are tranſported, inueſted with the two Membranes wherein the Braine it ſelfe is inueſted, commonly called the *Pia* and *Dura mater*. And this ſubſtance was indeede more fit for Irradiation then a conſpicuous or open cauity, which would haue made our motions & Senſations more ſudden, commotiue, violent and diſturbed, whereas now the members receiuing a gentle and ſucceſsiue illumination are better commaunded by our Will and moderated by our Reaſon.

The Natures of theſe three kindes of Spirites wee haue partly handled before in the third, the ſixt and the ſeauenth Books: & therefore we will no longer detaine the Reader by way of Introduction, but deſcend vnto their particular Hiſtories.

CHAP.

CHAP. I. *What a Veine is.*

HAuing wrought out way through the darke and shady groue of the muscles *Nullipenetrabilis astra*; into the secret whereof I thinke no wit of man is able to reach. (And therefore it shall be no wonder if we bring some scratches out of so thorny a copse) we are now arriued in these medows, where the vessels like so many brooks do water and refiesh this pleasant Paradise or modell of heauen and earth; I mean the body of man. And surely by these streames doe grow many pleasant flowers of learning to entertaine and delight our mindes beside the maine profit arising therefrom vnto the perfection of that art we haue in hand.

Vnder the name of vessels we vnderstand three kinds veines, arteries and sinewes, because out of these as out of riuers, doe flow into all the parts of the body Blood, Heat, Spirits, Life, Motion and Sense. Three kindes of vessels.

Wherefore *Hippocrates* in his booke *de Corde* calleth them ποταμοὺς φύσεως ἀνθρώπου, the riuers of the body of man. Neither let any man taxe vs for inuerting our order when wee first begin with the history of the veines, then descend vnto the arteries, and lastly vnto the nerues; because the veines are most simple as hauing but one proper coate and that thin; the arteries two and those thicker; but the substance of nerues is manifold, as being within soft and marrowy without membranous. For they must remember that the maine guide of our labour is the order of dissection. Now the originall of the veines is in the lower region, at which we began our discourse. The originall of the arteries in the middle region, and that of the nerues in the vpper.

A veine therefore is by the later Greeke writers absolutely called φλὲψ, *Eudoxus* calleth it ἐπαυθισμὸς, *Hesychius* δεξαμενὴ, because it is the canale of the blood. The Antient Physitions, as *Hippocrates* vsed φλὲψ as a common name to veines and arteries, so in his booke *de carnibus*, *There are two* κοῖλαι φλέβες, saith he, *two hollow veines issuing from the heart*: the one is called a veine, the other an arterie. Sometimes *Hippocrates* distinguisheth betwixt these two veines by adding the word σφύζειν, which signifieth to beate, as if he should say arteries are beating veines, veines those that doe not beate. Many places might be alledged to prooue this distinction if wee thought it needfull: *Auicen* cals the arteris beating and bold veines. *Cycero venas miconres* which doe sometimes lift vp themselues, and sometimes sinke againe. *Celsus* calleth them veines fitted for the spirits, and the true veines he cals *quietas*, *still* veines. *Hippocrates* in his booke *de morbo sacro*, to distinguish the veines from the arteries which are the conceptacles of the spirits calleth them αἱματίτιδες bloody, because they conuey the blood. The names of veines.

The latter Grecians haue included this name within narrower bounds and restrained it onely to quiet or still veines which haue but one simple coate, in whose footesteps we also doe insist calling the arteries not φλέβας but ἀρτηρίας, so the vessels beeing distinct their names also are distinct.

Furthermore, the vessels are distinguished in their structure motion and vse. In the structure, because a veine hath a thin coate, whereas the coate of the artery is very thicke. In their motion, because an artery is mooued perpetually and conspicuously with a diastloe and systole, that is, a dilation and contraction, whereas the veine is altogether immooueable. In vse because the artery transporteth the vitall spirit together with exceeding thin blood. The veines carry a thicker blood and a more cloudy spirit: the veins haue an inbred faculty to alter and boyle the blood; the arteries haue no such faculty, because their blood attaineth his vtmost elaboration and perfection in the heart. But let vs come to the definition of a veine. How veines & arteries differ.

A veine may be considered two manner of wayes, either as it is a Similar, or as it is an originall part. *Galen* in his 2. booke *de Elementis*, accounts it Similar, if not indeed, yet at least according to the iudgement of the sense; againe, in his boooke *de morborum differentiis*, he proueth that it is organical, for hee calleth veines arteries and muscles organs of the first kinde and most simple organs. Two considerations of a veine.

If you regard a veine as it is a Similar part, then must you define it by his temper, (for the temper is the forme of the similarity, that I may so speake) to be *A cold and drie part generated out of a slimy and following portion of the seed.* I sayde it was cold. In respect of his

his naturall temper for otherwise by the contaction of the blood and the perfusion of the spirits it is very hot. And in *Galens* first booke *de temperamentis* It is sayd to be hotter then the skin.

If you consider a vein as it is an organicall part, then shall you define it to be *A vessell long, round, excauated or hollowed like a reede hauing but one and that a thin coat, wouen with all kindes of fibres, arising from the liuer and appointed or set apart by Nature to contain, boyle and distribute the blood.* In this definition you haue the figure, composition, originall, vse and action of the organ elegantly described. The roundnesse and cauity of the vessel expresseth the figure of the organ whereby a veine is distinguished from a nerue, for nerues haue onely pores but no sensible cauities. *Praxagoras* therefore was in an error and so are those that follow him, who call nerues *venas continuatas* continued veines.

The explication of the definition.

The simple and thin coate noteth the structure of the vessell, and discriminateth or putteth a difference betwixt a veine and an artery, for an artery hath a double coate, one outward and another inward, and if we may beleeue *Erophilus* it is fiue-fold thicker then a veine, because it containeth thinner and more spryghtfull blood, which if it were not concluded or shut vp within thicke wals would easily breake prison and vanish away.

This simple coate hath fibres of all kindes, right, oblique and transuerse, if not for his owne priuate nourishment, to which the attracting, retayning, and expelling faculties are seruiceable; yet for a common vse to retayn and draw the blood which is the treasure of Nature, from the neighbour veynes to transmit the same from one to another and so to make distribution: finaly to separate the pure from that which is impure. I thinke also sayth *Laurentius* that the fibres were ordayned *ad εὐπάθειαν*, that is to auoyde an inconuenience, for because oftentimes the blood aboundeth in quantity and offereth a kinde of violence to the veynes. Sometime by right, sometime by oblique, sometime by transuerse extentions; he veynes stood in neede of all kindes of fibres, that they might bee so extended according to all the violent occursions and impressions made by the blood, for otherwise they would certaynly be broken. These fibres are the first, most simple and truly solyd particles of the veine, but that substance which filleth vppe or stuffeth out the spaces betwixt the fibres is called fleshy by Analogy or proportion.

The fibres of the veyne sayth *Galen* in his second booke *de temperamentis*, are colder then the skin, but the flesh that commeth betwixt them is hotter. Hence it appeareth, that the coate of the veyne differs much from the nature of other membranes, as of the *peritoneum* or rimme of the belly, the *pleura* which compasseth the ribs and the *periosteon* which immedyatly inuesteth the bones: for these are indeed simple hauing no separated fibres, and may be borne or diuided euery way as paper may. But the coate of the veynes is dissimilar because it hath both fibres and flesh.

The common coate of the veines.

This proper coate of the Veines is inuested oftentimes with another called a *Common coate* which it borroweth from the neighbour partes, from the *Pleura* the Veines of the Chest doe borrow, and from the Rimme those in the lower belly. I said they haue often a Common coate, for all veines haue it not, for example, those that are sprinkled thorough some bowell, those that wander through the bodies of Muscles, and finally those which are inserted into the parts & in them are propagated or encreased: for such a membrane would hinder the bloud that it should not so readily sweat through. Those Veines onely haue this common coate, which either doe runne a long iourney, or lye vpon some hard body, or at some place are suspẽded or hung to any particular part: & such is the structure of a Veine.

The common vse of the vemes.

The beginning of the Veines, the Definition sayeth is the Liuer, not a beginning of generation or *original*, (for that is the common worde though the first I thinke bee better) for all the parts are formed together: but of *Radication* and *Dispensation*. Of *Radication*, because the roots of the gate and hollow veines are sprinkled through the whole *Parenthyma* or flesh of the Liuer according to that of *Hippocrates* in his Booke *de Alimento*, ῥίζωσις φλεβῶν ἧπαρ *the Radication of the Veines is the Liuer*. Of *Dispensation*, that is, of distribution and office, because from it a common matter, to wit the bloud which is the common Aliment of all the partes, is deriued into the Veines; wherefore by *Hippocrates* it is called ἰχμαλέον the fountaine and originall of pleasant and benigne humour.

The last particle of the Definition designeth the common vse and action of the Veines, for they are set a part to leade or transport, to distribute or apportion & to boyle the bloud. But why this is so and how it commeth to passe, I wil now addresse my selfe to declare.

CHAP

CHAP. II. *Of the Vse and Action of the Veines.*

BEcause the threefold substance which is in euery particular part issuing from the originals or principles of our generation, doth continually wast and suffer detriment; Nature who is studious of her owne conseruation by a perpetuall affluence of Aliment, laboureth to restore and make good that which is so necessarily spent and depopulated. The common Aliment of the parts is the bloud, which all the Veines do draw from the Liuer as out of a common *magazine* or store-house. Now the bloud could not be transported from the Liuer to those parts which are most distant and remote from it, vnlesse those parts had some continuity with the fountaine. The necessity of the veines.

It was therefore necessary that there should be made and formed certaine canals as it were water-pipes, bored to containe, conserue and conduct the bloud throughout the whole body. Such are the Veines which *Aristotle* cals the vesselles or conceptacles of bloud. The bloud therefore is contayned in the veine as in his proper place, and as the Elemēts in their proper places receiue no alteration; (for the place is the conseruer of the thing placed) so the bloud within the veines retaineth his benigne nature, but out of the veines it presently either putrifieth or caketh. Their first vse

There is therefore in the Veines an inbred power to contayne and preserue the bloud, which also is their primary vse. Another vse that the veines haue is to distribute the bloud; which distribution is performed by an action, that is, by attraction or drawing from the neighbour veines, and by transmission or transportation vnto others, and for this action sake were the right and circular fibres of the veines ordayned. The second.

Hippocrates in his Booke *de Alimento* maketh mention of a third vse of the Veines, & that is to leade along heat and spirits into the particular parts. And thēce it is that though the Arteries bee tyed the partes doe not presently *sphacelate* or mortifie, becausse by the veines there is an influence of a double heate and spirit, that is to say, Vitall and Naturall. The Vitall they receiue from the Heart by the wonderfull Anastomoses or innoculations of the Arteries; the Naturall they drawe directly from the Liuer. By this influent spirite the Inbred *Genius* of euery part is rousedvp and quickned, and by it as by a good Mancible is the nourishment conuayed into the whole body. The third.

The last vse of the Veines which must bee referred also to their common action, is the alteration of the bloud, for they are qualified to coyne and change the bloud, some to prepare it as the Mesentery, others to perfect it as the great branches of the hollow veine. And this faculty or qualification they haue from the Liuer by *Irradiation*, as the Seminary vessels haue from the Testicles that power which they call *σπερματοποιητικὴν*. The fourth.

There are also other particular vses of priuate veines; as of the Emulgents to conuay the Serous or wheyie humor; of the seede vessels to giue a rudiment vnto seed; of the *Mesaraicks* to alter the *Chylus* and to transport it to the liuer; of the venall or short vessell to belch out melancholy iuyce into the cauity of the stomacke for the prouoking of appetite; of the veynes of the wombe to exclude the surplusage of blood at certaine and determinate periods, of the veynes of the splene to purge *fæculent* or drosy blood, and so of the rest: for particulars we shall better handle in the following discourse. Peculiar vses of priuate veines.

Hippocrates the Oracle of Physicke from the habite and structure of the veynes, drewe many and those notable signs of the state of the whole body. Those that haue broade veines, sayth hee, haue also broade bellyes and broade bones, for, becausse the blood through the veines is diuided into the whole body, we may well make estimation of the plenty and temper of the bloode by the amplitude or straytnesse of the veynes. They that haue much blood are esteemed hot for their veynes are large. If the veynes be narrow and slender, *Aristotle* accounteth them cold. They that haue much flesh haue small veynes, red blood, and little bellyes and bowels: on the contrary, they that haue litle flesh haue large veynes, blacke blood, great bowels, and side wambes or bellyes. Finally by the veynes the whole body hath a kind of connexion or coherence, whence it is that they are called common ligaments.

CHAP.

CHAP. III. *The differences of veynes.*

THere are of the veynes innumerable & almoſt infinite ſurcles, yet al of them are ſaide to flow from fiue trunkes or bowes. For Anatomiſts doe account fiue eſpeciall veynes. *The hollow veyne*, the *Gate veyne*, the *vmbilicall veine*, the *arteriall veine* and the *venall artery*. The *Caua* or hollow veyne is the largeſt of all the reſt. It iſſueth out of the gibbous part of the Liuer, and is diuaricated or diuided into the ſtomacke, the ſpleene, the guts, and the *Omentum* or Kell. The vmbilical veine which is the Nurſſe of the infant runneth from the fiſſure or partition of the liuer vnto the Nauill, and whileſt the infant is in the wombe it leadeth nouriſhment vnto it, but after the birth it looſeth that vſe altogether and degenerateth into a ligament. The arteriall veine hath both the name and office of a veyne, but is indeed an artery, and is all ſpent into the Lungs. The venall artery hath the coate and ſtructure of a veyne, and might better be called a veine then an artery. The branches of this veſſell are diuerſly diuided and diſperſed through the fleſh of the whole Lungs. There are therfore fiue veſſels commonly called veynes, which we (becauſe we endeuour to deliuer nothing but truth) will referre to two: the *Hollow* and the *Gate* veynes. For the vmbilicall veyne is a propagation of the Gate veyne, and is ſo continuated thereto that I cannot perſwade my ſelfe but it is a branch thereof. The venall artery is a ſhoote of the hollow veine, as may bee prooued by that wonderfull inoculation in the heart of the infant before the birth, of which we ſpake in the 25 queſtion of the fift booke, and the 15 chapter of the 6. The arterial veyne hath his continuity with the great artery, by the *Arterial veſſel* in thoſe places mentioned, and may rather be ſaide to be an artery then a veine, becauſe it hath a double and thick coate. There remain therfore but two notable veynes, the Hollow and the Gate veynes. The rootes of both theſe veynes are confuſedly ſprinkled through the fleſh of the Liuer, yet ſo that there are many moe rootes of the Gate veyne in the hollow ſide of the liuer, and fewer in the gibbous or conuex: on the contrary, there are many moe rootes of the hollow veyne which runne through the gibbous part of the liuer, and fewer through the hollow part: ſo that it ſeemeth ſanguification is made rather in the hollow of the liuer, diſtribution and perfection in the gibbous or embowed part. The rootes of theſe two veſſels (which hath beene obſerued but of late yeares) are wonderfully inoculated one with another, for the extremities or ends of the rootes of the Gate veyne are faſtened into the middle of the rootes of the hollow veynes, and the ends of the hollow veyne into the middle of the rootes of the Gate veyne, that ſo the bloud might flow and reflow out of one into another of them. *Ariſtotle* therefore in his ſecond booke *de partibus Animalium* ſaide true, (truer it may bee then hee wiſt, for haply hee had a Genius at his elbow) *that all the veynes were continuall*, yet *Hippocrates* before him hath the ſame thing in his booke *de locis in homine*; *All the veynes* ſaith he, *doe communicate and flow mutually one with and into another.*

And this ſaith *Lauren.* I haue ſomtimes proued to be true in childrē new born, for if you put a hollow bugle into the vmbilicall veine and blow it, you ſhal perceiue that the guts, the branches of the hollow veyne, the heart and the very fleſh of the Lungs will be diſtended becauſe the vmbilicall veine endeth into the Gate veine. Now in the parenchyma or fleſh of the liuer there are many inoculations of the gate and hollow veines. The hollow veine alſo hath a continuity with the venall artery, which is the proper veſſell of the Lungs by a large hole. This therefore ſhall be the firſt and moſt generall diuiſion of the veines.

The peculiar differences of veynes are taken from their magnitude, number, ſite, office, and the name of the parts to which they are deriued. In regard of the magnitude ſome are great, ſome middle, ſome ſmall. Great and large veines *Hippocrates* calleth κοίλας καὶ αἱμόῤῥους hollow and ſanguifluent becauſe they yeelde aboundance of bloud if they be eyther wounded, or broken, or opened. The leſſer veynes are called *Capillares*, hairy or threddy veines, becauſe when they be diuided they yeeld, but ſlender and ſmall ſtreames of blood, and are eaſily ſtanched. Thoſe parts that neede abonndance of nouriſhment or which are moued continually haue greater veynes. So the Lungs haue notable veſſels, ſo the fleſh and all hot and moyſt parts haue great veynes; but bones, griſtles, & ligaments very ſmall veines.

From the number; ſome veynes are without companions, as that in the Cheſt called

Azygos,

Fiue veſſels called veines.

Two veines onely.

Their inoculations.

Hippocrates.

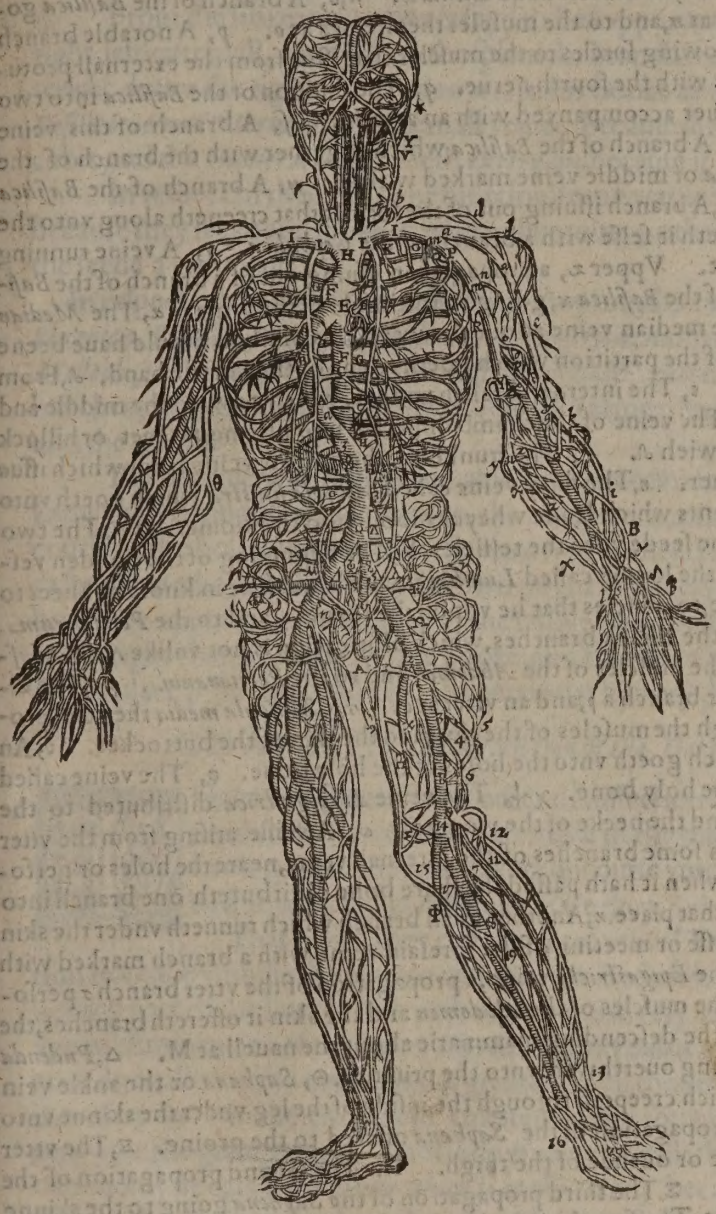
Laurentius his obſeruation.

The peculiar difference of veynes from the magnitude.

Number.

Table 1. *Sheweth the hollow veine, whole and freed from the whole Body.*

TABVLA I.



A, The trunke of the hollow veine.

the lower A A, At this place of the Liuer, is seated the left part of the veyne, and distributeth branches to the left side.

B, Sheweth how the trunke of the hollow veine in the chest, to giue way to the heart, is curued or bowed to the right hand.

Betwixt A and B; that part of the hollow veine which is betwixt the ribbous side of the Liuer and the Midriffe.

C, the left midriffe veine called *Phrenica sinistra*, from which surcles doe run in a man vnto the purse of the heart, for the midriffe and it do grow together.

D, the orifice of the hollow veine which groweth vnto the heart.

E, the crown-veine called *coronaria*, which like a crowne compasseth the basis of the heart, and sprinkleth his surcles on the outside thereof as farre as to the cone or point.

F F, the trunke of the veine, *Azygos* or *non paril* descending along the right side of the racke-bones vnto the loynes.

G G, the lower intercostall veines, or the branches of the veine *Azygos*, which go vnto the distances betwixt the ribs, and affoord surcles vnto the muscles which lye vppon the ribs and the racke-bones, and the membranes of the chest.

H, the diuision of the hollow veine into 2 subclauian trunkes neare the Iugulum vnder the breast-bone.

I I, the subclauian branch tending on eyther side vnto the arme, called by some *Axillaris*.

K, the vpper intercostall veine which commonly sendeth three slips vnto the distances of the vpper ribs, vnto which the first intercostall veine sent no branches.

L L, the descending mammary veine: this descendeth vnder the breast-bone vnto the right muscles of the *Abdomen*, and affoordeth surcles to the distances of the gristles of the true ribs, to the Mediastinum, the muscles that lye vppon the breast and the skinne of the *Abdomen*. M, the coniunction of the mammary with the Epigastricke veine ascending about the Nauill vnder the right muscles. N, the veine of the necke called *Cernicalis*, ascending toward the Scull which alloweth surcles to those muscles that lye vppon the necke. O, the veine called *Muscula*, which is propagated with many surcles into the muscles that occupy the lower parts of the necke and the vpper parts of the chest. P, *Tkoracica* superior, the vpper chest veyne which goeth to the muscles lying vpyon the chest, to the skinne of that place and to the dugges. Q, the double *Scapularis* distributed into the hollow part of the shoulder-blade and the neighbour muscles: so also betwixt *P* and R, sometimes small veines do reach vnto the glandules that are in the arme-holes. R, *Thoracica inferior* running downeward along the sides of the chest, & especially distributed into the muscle of the arme called *Latissimus*. S, the inner Iugular veine which entreth into the Scull after it hath bestowed some surcles vppon the rough artery. T, the externall Iugular veine. V. The diuision of this veine vnder the roote of the eare. X. A branch of the externall Iugular which goeth into the inside of the mouth, and is diuersly diuided into the parts therein contained. Y, the exterior branch distributed neare the *Fauces* into the muscles of the chops and the whole skin of the head. Z. A portion of the branch, y, reaching vnto the Face. *a a* the veyne of the fore-head, *a*, A portion of it creeping through the temples *a*, * A propagation that goeth vnto the skinne of the Nowle or *Occiput*. *a a* The veine called *Cephalica*, or the externall veyne of the arme which others call *Humeraria*. *b Muscula superior*, A propagation of the *Cephalica* veyne which goeth vnto the backward muscles of the neck. Betwixt *b* and *d* on the backeside issueth a branch from the *Cephalica* which passeth vnto the outside of the blade, and a portion thereof runneth betwixt the flesh and the skinne. *d d* A veyne from the *Cephalica* which attaineth vnto the top of the shoulder, and is consume d into the muscle that eleuateth or lifteth vp the arme & into his skinne. *e e* A small veine from the *Cephalica* dispersed through the skinne and the muscles of the

arme. *f*, The diuision of the *Cephalica* into three parts. *g*, The first branch runneth deepe vnto the muscles which arise out of the externall protuberation of the arme. *h* The second branch which goeth to make the *median* veine. *i i*, The third branch running obliquely aboue the wand and the outside of the arme. *k*, From this branch certaine surcles are diuided into the skin, the chiefe whereof is marked with *k*. *l*, The third branch at the wriſt which is ioyned at *l*, with the branch of the *Basilica* marked with *x*. *m*, The *Basilica* which on the right hand is called *Hepatica*, on the left hand *Lienaris*. *n*, *o*, A branch of the *Basilica* going to the heads of the muscles of the cubit at *n*, and to the muscles themselues at *o*. *p*, A notable branch of the *Basilica* running obliquely, and bestowing surcles to the muscles that issue from the externall protuberation. This branch descendeth together with the fourth nerue. *q*, The diuision of the *Basilica* into two branches, and that that is noted with *q*, is euer accompanyed with an arterie. *ſ*, A branch of this veine bestowed vppon the skin of the arme. *t* A branch of the *Basilica* which together with the branch of the *Cephalica* marked with *h*, makes the *mediana* or middle veine marked with *a*. *u*, A branch of the *Basilica* going to the inner head of the arme. *x x*, A branch issuing out of the former that creepeth along vnto the wreſt and toward the little finger conioyneth it selfe with a branch of the *Cephalica*. ~ *y*, A veine running out vnto the skin at the outside of the cubit. Vpper *z*, a propagation issuing out of a branch of the *Basilica* marked with *t*. Lower *z*, A branch of the *Basilica x*, going to the inside of the arme. *α*, The *Median* or common veine. *β*, The partition of the median veine aboue the wreſt, this diuision should haue beene made aboue *γ*. *γ*, The externall branch of the partition which goeth to the outside of the hand. *δ*, From which issueth a small branch to the inside. *ε*, The internall branch vnder *ε*, which toward the middle and the ring finger is especially disposed. *ζ*, The veine of the thumb disperſed into his mountenet or hillock which is conioyned with the branch noted wieh *δ*. *ζ*, The trunke of the hollow veine from which issue branches vnto the parts seated vnder the liuer. *η*, The fatty veine called *Adipoſa ſiniſtra* which goeth vnto the fat of the kidnies. *θ ι*, The two Emulgents which leade wheyey blood vnto the kidnies. *λ μ*, The two spermaticall veines leading the matter of the seede vnto the testicles. *V*, The beginning of the bodden vessell called *vas varicoſum*. *ξ*, The veines of the loynes called *Lumbares* which are sent in knots or knees to the rackebones, to the marrow of the backe, to muscles that lie vppon the loynes, and to the *Peritonæum*. *o*, The bifurcation of the hollow veine into the Illiack branches, which bifurcation is not vnlike *Λ*. *π*, *Muſcula ſuperior*, a transuerse branch going to the muscles of the *Abdomen* and to the *Peritonæum*. *ρ σ*, The diuision of the left Illiacke veine into an inner branch a *ρ*, and an vtter at *σ*. *τ*, *Muſcula media* the vtter propagation of the branch *ρ* distributed through the muscles of the *coxa* and the skin of the buttockes. *υ*, An inner propagation of the same branch *ρ* which goeth vnto the holes of the holy bone. *φ*, The veine called *Sacra* which goeth to the vpper holes of the holy bone. *χ ψ*, The veine *Hypogaſtrica* distributed to the bladder, to the muscles of the fundament, and the necke of the wombe. *ω*, A veine arising from the vtter branch marked with *σ* which is ioyned with some branches of the internall veine, neare the holes or perforations of the share bone. *ϖ*, A veyn which when it hath passed the share bone distributeth one branch into the cup of the *coxendix* & to the muscles of that place. *x*, Another small branch which runneth vnder the skin at the inside of the thigh. *χ*, The congresse or meeting of the foresaid veine with a branch marked with char. 2, and distributed into the leg. *Γ*, The *Epigaſtricke* veine, a propagation of the vtter branch *σ* perforating the *Peritonæum*, whereto as also to the muscles of the *Abdomen* and the skin it offereth branches, the chiefe branch of this veine is ioyned with the descending mammarie about the nauell at M. *Δ*, *Pudenda* an inner propagation of the branch *σ*, running ouerthwart vnto the priuities. *Θ*, *Saphæna* or the ankle vein or the inner branch of the crurall trunke, which creepeth through the inside of the leg vnder the skinne vnto the tops of the toes. *Λ*, The first interior propagation of the *Saphæna* offered to the groine. *Ξ*, The vtter propagation thereof diuided to the foreside or outside of the thigh. *Π*. The second propagation of the *Saphena* going to the first muscle of the leg. *Σ*, The third propagation of the *Saphena* going to the skinne of the whirlebone, and vnto the Hamme. *Φ*, The fourth propagation of the *Saphena* disperſing his surcles forward and backeward. *Ψ*, Branches from this vnto the foreside of the inner ankle, to the vpper part of the foote, and to all the toes. *Ω*, *Iſchias minor* called also *muſcula interior*, the vtter branch of the crurall trunk diuided into the muscles of the *coxendix*, and to the skin of that place. 1, 2, And this also may be called *muſcula*. 1, the exterior and lesser which passeth into some muscles of the leg: 2, the interior greater and deeper vnto the muscles of the thigh. 3, 4, The veine called *Poplitea*, made of two crurall veines diuided vnder the knee. 5, From this a surcle is reached vpward vnto the skinne of the thigh. 6, But the greater part runs by the bent of the knee vnder the skinne as farre as to the heele. 7, Also to the skin of the outward ankle. 8, The veine called *Suralis* or calfe veine, becauſe it runneth vnto the muscles that make the calfe of the leg. 9, The diuision of the Surall veine into an exterior trunk 9 and an interior 14. 10 11, The diuision of the exterior trunke vnder the knee into an externall branch, which along the brace attayneth vnto the muscles of the foot 11, and in internall, 12, 13. 12, 13, Which descending a longthe outside of the legge to the vpper part of the fotte is clouen into diuers branches, and in the backe of the foote mixeth it selfe with *Poplitea*, or hamme veine 20. 14, The interior branch of the Surall veine which runneth into the backeside of the leg. 15, A branch hereof descending to rhe inside of the heele and the great toe and is diuided into diuers surcles. 17, *Iſchias maior* issuing out of the internall trunke at 14, and running through the muscles of the calfe. 18, A propagation hereof deriued vnto the vpper part of the foot, and affording two surcles to euery toe. 19, The remainder of the inner trunke 14, behinde the inner ankle, approcheth to the bottome of the foote and is consumed into all the toes. 20. the commixtion of the Veine *Poplitea* with the surall or Calfe-branch at 13,

are

Azygos or the *namparell*. Others haue companions, as almost all the rest. Others agine are solitary, that is, haue no artery accompanying them, as the veine of the arme which is called *Humeraria*, others haue arteries bearing them company.

This by the way we must obserue, that the veines are more and greater then the arteries, because they containe a thicker Aliment and more cloudy spirit;

From the situation a veine is sayd to bee vpper and lower, ascendent, descendent; right, left; externall, internall, so the splenicke branch is called *sinister* the left, the mesentericke *dexter* the right. So *Hyppocrates* in his booke *de victus ratione in acutis*, calleth the *Basilica venam internam*, the internall veine, because it runneth through the inside of the cubit, and the *Humeraria* he calleth *externam*, because it runneth on the outside.

In respect of their office or function, some veines are called *Emulgentes* the suckers because they sucke and separate wheyie humours; others *spermaticæ*, because they giue the seede a rudiment.

In respect of the parts through which they run, the veins haue diuers names, *Jugulares*, *Phrenicæ*, *Renales*, *Iliacæ*, *Hypogastricæ*, *Epigastricæ*, *Axillares*, *Humeratiæ*, *Crurales*, *Popliteæ*, *Malleoli*, &c. because they run through the sticking place, the midriffe, the kidneyes, the hanches, the watercourse, the lower belly, the arme pits, the armes, the legs, the hammes and the ankles.

But because you might haue, as it were, in one view all the veines of the body, to know their deriuations, we haue to this chapter annexed a table which exhibiteth the course of the hollow veine from the crown of the head to the soale of the foote, and the description adioyned thereto, which wil poynt out euery particular. As for the skin veines how they appeare on the surface of the whole body, you haue also a general view of them in the eight chapter of the second booke, and therefore we will not repeate their Tables in this place, but descend vnto the particular hystory, beginning with the gate veine.

CHAP. IIII. *The description of the Gate veine and his branches.*

I Gaue you (because the order of dissection so required) a briefe compend of the distribution of the Gate veine in the third chapter of the third booke, reseruing there the more exact discourse vnto this place; which therefore we will now attend as carefully as we may.

That which they call the Gate veine [Tab. 2.] some thinke is a propagation from the vmbilicall veine, to which as we sayde it is continued. It issueth out of the hollow part of the liuer, which part or rather the very ingresse of the vessell (betwixt the 2. small Eminencies of the liuer) *Hippocrates* and *Galen* and the whole family of the *Asclepiads* doe call πύλας the *Gate*. It is the greatest of all the veines next the hollow veine, and therefore *Galen* in the twentyeth chapter of his fourth booke *de vsu partium* calleth it μεγάλην, or the great veine. The hollow veine he calleth μεγίστην, or the greatest veine, but commonly he cals it *the veine which is at the Gate*, because by the roots hereof, that is to say, the Mesaraicke branches the *Chylus* is suckt away from the stomacke and the guts, and through the trunke hereof as through an open gate is let into the liuer. Whereupon the *Mesaraicks* are called *manus hepatis*, *the hand of the liuer*. The Physitions call it commonly *vena portæ*, the gatevein; the Arabians *venam lacteam*, or the milky vein, because it draweth the *Chilus* which is like vnto milke.

The names of the gate vein and the reason thereof.

For order sake we will diuide this Gate veine into rootes, branches, and the trunke it self. The roots are small and aboundant, desseminated [tab. 2. ch. 1, 2, 3, 4, 5.] through the substance of the liuer from whence as from a principle of distribution (saith *Galen* in the fourth chapter of his booke *de formatione fœtus*, and in the third of the seuenth *de placitis*) and of Radication (saith *Hippocrates* in his booke *de Alimento*) they doe arise. These small rootes by degrees grow into greater, and those yet into greater, till all of them about the middle of the liuer on his hollow side neare vnto the backe are vnited, and make one notable trunke [Tab. 2. B.] which issueth out of the liuer. These rootes whilest they remaine in the liuer, are ioyned by inoculation into the middle of the rootes of the hollow veine as wee haue shewed in the thirteenth chapter of the third booke and the fourteenth table.

The diuision the gate vein

In dogs there are so many bowes of the gate veine as there be lobes of the liuer, euery one of which is diuided into his owne lobe, and yet all of them meete into one common trunke. Notwithstanding they may be called Rootes and Branches. Rootes, be-

cauſe this veine is ſayd to be the ſprout of the Liuer, and becauſe they leade blood vnto other parts. They may alſo bee called braunches becauſe the meſaraicks (which *Galen* likening it to a tree, calleth the Rootes) when they haue ſuckt the Chylus doe ſend it vnto the Trunke, from whence by theſe branches it is diſtributed into the Liuer.

Sometimes from the rootes of the Gate-veine from the very top of the left part of Liuer neare his Ligament, yſſueth a braunch which is communicated to the Midriſſe, and deſcending on the backeſide is ioyned vnder the *Pancreas* or Sweete-breade with other braunches which ariſe out of the trunke of the gate-veine. Sometime alſo a few branches ariſing out of the ſame place doe attaine vnto the Spleene and are diſſeminated into his ſubſtance.

The trunke. The trunke [Table 2.B] deſcending from the Liuer runneth a little obliquely downeward vnder the Gutte called *Duodenum*, hauing gotten a firme ſeate aboue the Rackebones.

It maketh his diſtribution betwixt the Stomacke and the Guts as in the fitteſt place, becauſe it is the middeſt of the organs of nouriſhment where it was fit that diſtribution ſhould be, that the veines might be equally deuided amongſt them. For if it had deſcended lower it had departed too farre from the Stomacke. If it had aſcended higher, firſt it would haue beene too far from the Guts; and againe, could not haue had ſo eaſie acceſſe vnto the ſtomacke, which ſometimes ſtrutteth with aboundance, and againe falleth when it is empty. From this Trunke therefore diuers propagations are diſtributed in the lower belly into the Stomacke, the Guts, the Kell and the Spleene.

Where deuided & why.

The trunke. *Cyſticæ Gemellæ* The Trunke [Ta.2.B] before it is deuided parteth with two ſmall braunches from his foreſide. The firſt are called *Cyſticæ Gemellæ* the Twinne-veines of the Gall [Tab.2.C C] which yſſuing from toward the left ſide of the trunk are reflected vpward and toward the right ſide vnto the neck of the bladder of Gall and the body thereof, through which they are diſtributed in hayrie braunches as are the ſmall veſſels through the white of the Eye. *Gaſtrica dextra* The ſecond is called *Gaſtrica dextra* [Ta.2.D] the right ſtomacke veine. It ariſeth much lower then the twins and rather from the right ſide of the Trunke on which ſide it paſſeth onely vnto the backepart of the ſtomack and the *Pylorus* or lower mouth thereof, and affordeth them ſmall branches.

Afterward the Trunke inclining to the left hand is deuided into two notable bowes [Ta.2.E] the vpper or the left, and the lower or the right. The vpper [Ta.2.F] although it be altogether ſpent into the Stomacke and the Kell; yet from the vſe it is called *Splenicus* or the Spleene-braunch, becauſe it draweth to it ſelfe out of the *Chylus* altered in the *Meſeraicke* veines the thick part of the iuyce before it be gotten to the Liuer, and leadeth it to the Spleene as we haue ſayde before in the Hiſtory of the Spleene, wherefore alſo it is placed aboue the trunke of the Meſeraicks. [Ta.2.G] The lower bow is called *Meſentericus* the meſentericall braunch [Ta.2.G] becauſe almoſt all of it is diuided into the Meſenterie.

Ramus ſplenicus

Meſentericus.

The Splenicke braunch being ſupported with the Membrane of the Kell and a glandulous body, runneth ouerthwart to the Spleene, and before it bee conſumed thereinto, there proceede braunches out of it, ſome before ſome after the deuiſion. Before the diuiſion ſome yſſue from the vpper part ſome from the lower. From the vpper part two veines ſpring.

Gaſtrica minor. The firſt is called *Gaſtrica minor* the leſſer Stomacke veine, and [Table 2.K] the left is deuided into the gibbous and backepart of the ſtomacke with a few branches.

Gaſtrica maior. The ſecond is called *Gaſtrica maior* [tab.2.N] the greate ſtomacke veine, becauſe it is the largeſt of all the veines that come vnto the ſtomacke. It runneth obliquely vnder the Stomack to his vpper orifice or mouth, & is deuided thereinto, ſending out of the trunke three boughes; of which, one on either ſide is conuayed to the Stomacke, [Ta.2.OO] the middle runneth vpward and compaſſeth the vpper mouth of the ſtomacke like a crowne, and maketh that veine which thereuppon they call *Coronariam ſtomachicam* the Crowne veine of the ſtomacke, [tab.2.Q] which in dogges is very conſpicuous. From this veine ſome ſmall ones are offered vpward vnto the end of the Gullet, ſome downeward to the Stomacke.

Coronaria ſtom.

Sometimes alſo another braunch ariſing from the other propagation runneth downward, and on the foreſide paſſeth the *Pylorus* or lower mouth of the ſtomacke with many Surcles. From the lower part yſſue three branches.

The

The first is called *Epiplois dextra* [Ta.2.L] the *right Kell veine.* It is but a slender vessell, and deriueth his Surcles downeward to the right side of the lower membrane of the Kell, and to the Collicke Gut which is thereto annexed. *Epiplois dextra.*

The second is called *Epiplois postica* [Tab.2.S] the *hinder Kell veine.* It is larger then the former and is deuided into 2. branches which are very much separated, out of which sureles doe runne downeward to the lower membrane of the Kell, (wherewith the Collicke Gut is tyed to the backe as it were with a Mesentery) and to some part also of the *Colon* it selfe. In Dogges there is no veine from the spleenicke braunch vnto the Collicke Gut. *Epiplois postica.*

The third called *Pancreæ* [Table 2.M] are many small and capillary veines which run betwixt the two Kell veines as well aboue as below, and are disseminated into the Sweetbread which is called *Pancreas* from whence they haue their name. *Pancreæ.*

When these branches are produced, the Splenicke [tab.2.F] Trunke is cleft into an vpper and a lower brance, [ta.2 T] and these into others.

From the vpper braunch doe arise sometimes three, sometimes more, sometimes one from the top of the branch neare the Spleene which they call *Vas breue* [Ta.2. the vpper Z] or *Vas venosũ*, the *Short* or the *Venall vessell*, which is in some men greater, in some men lesser, and these latter doe easily indure hunger, the former with great difficulty. And hence it is that some men if they bee neuer so little a while without meate, or betweene their refections they fall into a *Syncope* or swounding; by this braunch also come oftentimes blacke vomits. *Vas breue.*

[*Table 2. is the same with Table 3. lib.3. Folio* 100]

These Veines being sustayned with the vppet membrane of the Kell, are inserted into the left side of the bottome of the Stomacke, and sometime higher that they might belch that naturall melancholly bloud which could not bee chaunged into the Aliment of the Spleene, into the bottome of the stomacke sometimes into his mouth (which *Vessalius* witnesseth that he hath seene) to stirre vp the drowsie appetite with his tartnesse, before the mouth of the stomacke be corrugated for too much want, for that sowre thinges doe prouoke appetite, we are taught by the sharpe Sallets that are vsed in the beginning of our Suppers. Beside the adstriction or binding property of this humour strengthneth the mouth and helpeth the concoction of the body of the stomack. Sometime also from another propagation of this braunch, veines are transmitted to the stomacke, and these tye the stomacke and the Spleene fast together.

From the lower braunch of the Splenicke bough proceede two veines. The first is called *Epiplois sinistra* or the *Left Kell veine* [Ta.2.V] which in one or two surcles is distributed into the left part of the lower membrane of the *Omentum* or Kell, especially when the hinder Kell veine is narrow, wherefore this veine is not alwayes found. *Epiplois sinistra*

The second is called *Gastro-epiplois sinistra* [Ta.2.X] the left Stomacke and Kell veine. It is a notable braunch, and reflected to the right hand compasseth on that side the bottome of the stomack where the smal branches of this veine are intangled with the slender surcles of the right, and touch either the others extremities. It affordeth also small branches, but very plentifull to the left side of the vpper membrane of the *Omentum.* *Gastro epiplois sinistra.*

The remaynder of both braunches being diuersly wouen together, are implanted in great aboundance [Ta.2.YZ] into the hollow and middle line of the Spleen, and are distributed through his whole body to purge the fœculent iuyce, & to lead it to the spleen, and thus much of the left or vpper branch of the gate-veine.

From the lower and Right branch [Ta.2.G] which is also the larger, before it be deuided, two veines do yssue.

The first is called *Gastro-epiplois dextra* [Ta.2.H] the *right Stomacke or Kell veine.* It yssueth from the side of the braunch before it be deuided into the mesenterical branches. Sometime it ariseth out of the Trunke it selfe, sometimes also but very rarely out of the left braunch, and on the right side watereth the bottome of the stomack both before and behind with many small surcles which insinuate themselues euen into his cauity. It creepeth also through the vpper membrane of the Kell, and at the middle of the stomacke it ioyneth his small surcles with the left *stomacke and kell veine.* [Ta.2.X] In Dogges sometime it yssueth from the Gut-veine. Sometime it is wanting and then the left supplyeth the place of both. Brãches from the right bow of the gate-veine. *Gastro-epiplois dextra.*

Inteſtinalis. The ſecond is called *Inteſtinalis*, [Tab.2, I] or the gut-veyne. It iſſueth ſometimes out of the branch, ſometimes out of the trunke at the middle of the *Duodenum* or the beginning of the *Ieiunum*, and running directly downeward through their length, it diſperſeth certain ſmall branches as fine as hayres through the vpper *Omentum* and through the *Pancreas*.

Afterward the whole branch [Tab.2,c] where it ioyneth with the meſentery, departeth into three meſentericall branches, two on the right hand and two on the left.

The right meſentericall branch is double, [Tab.26,] and is implanted into the *Ieiunum*, the *Illion*, the *Cæcum*, and the right part of the Colon on the backe or hollow ſide, and being diuided into inumerable ſurcles, as the rootes of a Tree are diuided into ſlender ſtrings (whereto alſo *Galen* compareth theſe) they make the meſeraicke veines [Tab.2. dddd] which run obliquely betwixt the two membranes of the meſentery, and amongſt which there are many ſmall glandules placed to ſerue their paſſage and determine in the Guts; not into their cauity, for that is compaſſed about with a cruſt, but their little mouths do open into the coate of the gut, from whence they ſucke the Chylus as the tendrils of a roote ſucke the Iuice out of the earth. Wherefore in the guts called *Ieiunum* and *Ileon* they are more aboundant, becauſe they contain a greater quantity of Iuice then the great guts doe.

The meſeraicke veynes

But they were not onely created to leade away this Iuice, but alſo to attract it and prepare it for the Liuer, after a manner, ſaith *Galen*, moſt like vnto it ſelfe, becauſe their nature is alike, and they draw their firſt originall therefrom; wherefore after they haue giuen vnto it the beginning or rude forme of blood, and out of them and from the blood the thicker part is drawne by the Spleene through the ſplenicke branch, [Tab.2,F] they lead it vnto the Liuer. For as Porters doe carry the dreſſed Corne into the Garner or common Store-houſe of a Citty where it is prepared for nouriſhment, ſo the meſeraick veines doe conuey the aliment laboured in the ſtomacke to the common place of the creatures concoction, that is, vnto the Liuer, not to poure it into his ſubſtance there to be changed into blood, but to be reſerued and laboured in the rootes of the Gate-veine, which are moſt what on the inſide and hollow part of the Liuer, for vnto theſe rootes the Liuer giueth the power of ſanguification as we haue ſaide before in the tenth Chapter of the third booke.

The double worke of the meſeraicks.

Moreouer, the ſame meſeraicks by which the diſtribution is made of the Chylus from the guts to the Liuer, do alſo carry blood from the Liuer to the nouriſhment of the guts, yet not at the ſame time, but when they are empty and want nouriſhment, and if it happen that both workes concurre together, which *Galen* yeeldeth to bee ſo in the ninteenth chapter of his fourth booke *de vſu partium*, then according to the diuers nature, deſire, & ſtrength of the drawing parts, the veynes of the Liuer ſnatch the Chylus and the guttes blood. For if you make Iron and Strawes in powder together and mingle them, heated Amber will draw away the ſtrawes, and a Load-ſtone wil draw away the Iron by reaſon of their diuers natures and diuers deſires of attraction.

Why there be no values at their ends. Againſt *Columbus*.

Now this double attraction could not be performed if the extreame orifices of the veines had values ſet vnto them as *Columbus* dreamed, but *Archangelus* refuteth by many arguments, who ſaith *Columbus* was deceiued by that cruſt which is ingendered of the excrements of the third concoction, and compaſſeth the guts no otherwiſe then the Scarfe-skinne cloſeth the extremities or ends of the cutany veynes.

Beſide, if there were any ſuch values they would hinder the confluence of the humors from the whole body into the guttes, which is made eyther by the want of Nature or of medicine, for ſaith *Galen* 3 naturall: facult: the purgations of the whole body are made by the meſeraick veynes, eſpecially by the lower of them, and ſo much of the right meſentericke branch.

The left meſentericke.

The left meſentericke veyne [Tab.2,c] is diſſeminated into the left and middle part of the meſentery, and attaineth that Region of the collicke gut, [Tab.2,ee] which reacheth from the left ſide of the ſtomack euen vnto the right gut.

The inrernall Hemrod-veynes.

From this deſcendeth a notable branch called *Hæmorrhoidalis interna*, [Tab.2,gg] *the inward emrod veyne* (for the externall proceedeth from the hyppogaſtricall branch of the hollow veyne) and it runneth by the end of the collicke gut vnder the right gut, [Tab. 2,ff] whoſe extremity (which they call the Fundament) it compaſſeth about with a fewe ſmall ſurcles, by which expurgation is made oftentimes in obſtructions of the ſpleene, of

fœculent

fœculent blood when it is too aboundant, and that in many bodies at certaine and determinate times.

This veyne taketh his originall sometimes from the splenicke branch, from which also the Short or Venall vessell issueth: and thus much concerning the branches of the Gate-veine.

Now the difference betwixt the Gate and the Hollow veynes is, that the Gate-veyne is more lax and soft, the Hollow-veyne faster and harder, because the Gate veyne serues rather from attraction then for expulsion, for by it the spleene and the Liuer draw more then they do expell. *The diference betwixt the Gate and the hollow veyne.*

On the contrary, the gate veine serueth rather for expulsion then for attraction, for by it the blood is expelled into the whole body although it is not a little assisted by the attraction of the members.

The vse of the gate-veyne is to distribute branches which may eyther serue for nourishment as those that leade blood into the naturall parts destituted and forsaken by the hollow veyne, or for the expurgation of some excrement as the splenicke branch which draweth vnto it selfe out of the trunke of the gate-veyne, before the Chylus attaine to the Liuer, a thicke and fœculent humor yet mingled with much laudable Iuice, and the *vas Brene* and the *Hemorrhoid-veyne*. Other branches make for the distribution of the Chylus into the gate of the Liuer, in which also it receiueth an alteration & preparation of blood as the meseraicks and those veynes which we saide attained vnto the stomacke to draw a part of the Chylus euen from thence. *The vse of the gate-veyne and of his branches.*

Finally, others perfect the blood as those small veynes disseminated through the flesh of the Liuer, which we called the rootes of the Gate-veyne.

Note moreouer that all the gate-veyne lyeth within the body, neuer attaining vnto the skinne, and therefore his branches are not opened vnlesse haply about the nauel, where they make the Emrods, (to which we do more often apply *Horsse-leaches*) and in women at the necke of the wombe: and so much of the Gate-veyne. *Note.*

CHAP. V. *Of the descending trunke of the hollow veine.*

THE hollow veine called *cana*, because of his large cauity, is by the Grecians called κοιλὴ and μεγάλη the great veine, *Galen* sometimes, as in the fifth chapter of his fourth booke *de vsu partium* calleth it μεγίστη, the greatest veine. *Hippocrates* callet it ἐντερικὴν *Iecorariam* the liuer veine. This is the common mother of all the veines, except the vmbilicall and the gate veines. It hath one beginning of *Originall*, that is, the seede, for it is made at the same time with the other spermaticall parts which are made or generated together, though some of them bee perfected and absolued before others. *The name of the hollow veyne.* *His begining*

Another beginning it hath of *dispensation* and *radication*, and that is, the Liuer, and therefore it is said to issue out of the gibbous part of the Liuer, where his substance is greter and thicker. For although the orifice of the hollow veine at the right ventricle of the heart be much larger then his capacity is in any other place; yet it doth not thence folow that it must arise from that right ventricle as *Aristotle* imagined, and after him *Vesalius* rather to carpe at *Galen* then that he was mooued thereto by any waighty reason. *Whereof it is made.*

For the making and framing of this hollow veine, [tab. 3. fig. 2. and 3. and Tab. 4. shew it,] out of the vtmost circumference of the Liuer in the gibbous part thereof, [Tab. 2. fig. 2. C C.] do arise innumerable propagations of small veines [tab. 3. fig. 4. C C c. Ta. 4. E E EE. [which creeping by degrees toward the middle of the backside of the liuer, [tab. 4. C. C.] doe meete together, or vnite themselues into larger veines, & these againe into greater, till at length they all passe in the vpper part of the liuer where it regardeth the right side of the backe into two very notable branches [tab. 3. fig. 3. M, N.] the one dispersed into the right, the other into the left part of the Liuer: both which doe determine into one stalke,] Tab. 3. fig. 2. F. fig. 4. A. tab 4.] which is called cõmonly *the trunke of the hollow veine*. VVherefore this trunke applyeth it selfe, or inclineth from the right side of the liuer to the backe side where it entreth, as it were into a *sinus* or cauity, and with a short passage groweth to his substance.

This trunke is seated according to the length of the backe, and runs with a streight course throgh both bellyes that so it might conuay vnto the whole length of the creatures blood (which

Table 3 is the same with Table 13 Lib. 3 folio 130

(which is the common Aliment of all the parts) laboured in the Liuer in the rootes [Tab. 3, fig. 4. F F, tab. 4 K K K K] of the Gate-veyne; which rootes are implicated or intangled with the rootes of the hollow veyne, [Tab. 3, fig. 4, C C, Tab. 4, E E E E] disperſed confuſedly through the fleſh of the Liuer touching one another in many places ouerthwart, [ta. 3, fig. 4, and tab. 4 ſhew this.] Many rootes alſo of the Gate-veyne do infix or faſten their extremities or terminations into the middle of the rootes of the hollow veyne, [tab. 3, fig. 4, G G G G Ta. 4, L L L] as on the contrary many ends of the rootes of the hollow veine are faſtened into the middle of the rootes of the gate-veine. By which Anaſtomoſes or inoculations the blood is tranſmitted out of one veyne into another, and ſo conueyed into the whole body. For the hollow veyne is like a water-pipe full of blood which hath many riuerets ſome greater and ſome leſſe iſſuing therefrom and diſtributed into all the parts. For Nature in this adminiſtration is not onely very prouident but alſo equall & indifferent, and therefore diuideth this veyne into many ſmall parts, that each meber might haue his due proportion, that is to ſay, Aliment anſwerable to the ſubſtance that waſteth away. So hot and ſoft parts and thoſe that are much exerciſed do ſuffer great expence as the Lungs, and therefore their veyne is very large: but colder and harder parts which are moderately exerciſed, are not ſo eaſily diſſolued, as the bones which therefore haue very ſmall & ſlender veines. Betwixt theſe are all the other parts whereof ſome haue more euacuation and ſome leſſe, and therefore they want more or leſſe nouriſhment.

The inoculations of the gate and hollow veine.

Table 4 is the ſame with Table 14. Lib. 3. folio 132.

The hollow veyne for order ſake, and perſpicuity we diuide into an vpper trunk [ta. 3, fig. 3, [D] fig. 4, [A] ta. 4, aboue [A]] and a lower, [ta. 3, fig. 2, at [c] fig. 4, [B] ta. 4, [DD]] the vpper piercing through the midriffe and climing vpward diſtributeth very many branches into al the ſupior parts, of which we ſhall ſpeake in the next chapter.

The deſcending trunke of the hollow veine.

The deſcending trunke [ta. 5, [X]] is leſſer then that which aſcendeth, becauſe the vpper parts do require more blood; for that many parts in the lower belly contained receiue branches frō the Gate-veine. It adhereth on the right hand to the bodies of the rackbones (for on the left ſide [ta. 5, [A]] the trunk of the great Artery lyeth vpon them) and before it depart altogether from the Liuer, it diſperſeth certaine ſmall branches into his ſubſtance which are not in all men of the ſame number. After it leaueth the Liuer, it diſcendeth inclining ſomething obliquely inward and diſpoſeth from it ſelfe many branches of which we will now intreat.

The lower trunke of the hollow veyne [tab. 5, [X]] is diuided into a trunke and branches. From the trunke which runneth vnto the great rack bone as *Hippocrates* cals it, or to the holy-bone, [tab. 5, [R]] commonly there iſſue foure veynes on each ſide.

Adipoſa ſiniſtra

The firſt is called *Adipoſa ſiniſtra* the left fatty veine. [Tab. 5. [E].] It iſſueth out of the left ſide of the trunke (although *Euſtachius* be of the contrary minde) and preſently being diuided ſendeth one part to the fat, and to the vpper part of the vtter membrane of the kidneyes for their nouriſhmenr as farre as to the middle of the kidneys. It ſendeth alſo to the glandule which groweth aboue the kidney and to the midriffe it ſelfe [Tab. 5. [A]] which veines on the inſide are very conſpicuous and vnited with the veines of the midriffe.

The other part it diſtributeth into the lower part of the foreſayde membrane.

Dextra.

The right branch ariſeth rarely from the trunke, moſt what from the vpper part of the middle paſſage of the emulgent [ta. 5. [F]] becauſe the liuer which in this place is ſomwhat thicke [tab. 5. [B C]] & ſtoppeth vp or intercepteth the way vnto the hollow vein, and therefore the left is for the moſt part aboue the right, yet it is diſtributed after the ſame manner that the left was. And ſometimes perforateth the glandule which groweth vpon the kidney with a ſurcle, which afterward is conſumed into the vtter membrane of the kidney.

Their originall diuers.

It is very rare if both of them be produced from the Emulgent; more rarely do the two veins iſſue from the hollow vein aboue and neere the original of the Emulgent. The vpper of them reacheth a ſmall branch vnto the glandule, the lower is by another ſurcle ioyned to the branch which runneth from the feede veine of the ſame ſide.

But if the left Emulgent be the higher, then ſometime out of it the left *fatty veine* taketh his originall and the right from the trunke. So ſometimes on the right hand betwixt the fatty veine and the Emulgent there iſſueth another veine which ſprinkleth his branches vp into the midriffe, into the vpper part of the ſubſtance of the kidny and into the glandule of the ſame ſide.

After-

Afterward when the trunke of the hollow veine hath attayned vnto the twelfth Rackbone of the Chest, and the first of the Loynes, then yssueth out of it the Emulgent.

The Emulgent which is the second of the foure we before made mention of, is so called from his office or function. In like manner because it is inserted into the Kidney, it is called *Renalis* the *Kidney-veine*. The Emulgents.

[*Table 5 is the same with Table 8. Lib. 3. Folio 115.*]

It is the largest of all the veines that yssue out of the Trunke [Ta. 9.d] for it is very thick yet short because they are as it were drawing stomackes and seruiceable to the Kidneyes. In Men and Apes they are on either side commonly but one, [Tabl. 5. vnder d e] notwithstanding sometimes the right Emulgent is double, euen from his originall as appeareth in the third Table of the fourth Booke the first Figure Char. 1. and 2. Sometimes it is treble, rarely double on either side, and this variety is not onely found in diuers bodies, but also in one and the same, so as the vessells of the right side differ much from those on the left.

Their originall is seldome directly opposite one vnto the other, least the function or office of one should be interrupted. But the left is higher then the right in men but not in Dogges, because the left Kidney by reason of the smalnes of the Spleen, standeth higher, whereas the right is borne downe into a lower place by the magnitude of the Liuer. [Tab. 5.] The left Emulgent also is larger then the right, because of the Spermatical veine which was to arise therefrom. Sometimes also from the lower part of the left Emulgent where it is implanted into the Kidney, there yssueth a small braunch which is transmitted vnto the lower part of the fat membrane, and is oftentimes ioyned with the Spermaticall. The iourneyes of both the Emulgents is short and oblique, as appeareth in the third Tab. of the fourth booke; and about the middle and concauous Region of the Kidney before they get into their cauity, oftentimes in the very middle of their passage they are deuided into two or three, more seldome into foure or fiue equall braunches, which *Hippocrates* in his booke *de ossium Natura*, compareth to Anchors fastned in the cauity of the Kidney. These braunches of the Veine and the like of the Artery are implanted into deuided parts of the Kidneyes not ascending, which is rare and then only when it yssueth out of a lower place, but descending, and those braunches are in great numbers subdiuided into the substance of the Kidneyes till they become as small as hayres. their original. Their progresse & diuision.

The vse of these Emulgents is to suck and draw the whaey or serous moysture from the blood and to drayne it, they conuay also therewith a part of the bloud it selfe for the nourishment of the Kidneyes, but least this bloud and whay should returne backe into the hollow veine, Nature hath placed values or flood-gates, as it is also in the Veines of the Spleene. Their vse.

The third veine that yssueth from the descending trunke, is called *Spermatica*, or *Seminalis* the Seed-veyne.

The right of these [tab. 5 h] which is sometimes double, ariseth with a swelling originall from the vpper side of the Trunke below the Emulgent rarely close to it, from which notwithstanding somtime it receiueth a small branch. The left ariseth [tab. 5, i] almost alwayes from the middest on the lower side. The reason whereof is because if it should haue stradled ouer the great Artery, [tab. 5, L] so small a veyne would haue beene indangered by his pulsation: for eyther the continuall motion must haue broken it, or at least haue interrupted his office.

There is also somtime ioyned to this left Seed-veyne, a branch issuing from the trunk it selfe. The reason was, because the blood of the Emulgent being wateriſh, might bee assisted by the purity of the blood of the hollow veyne.

These Seed-veynes descending obliquely, and passing through the productions of the *Peritonæum* or rimme of the belly aboue the share-bone, at the head of the Testicles are diuersly contorted and so attaine vnto that which they call *Varicosum corpus* or the *Bodden body* leading thether from the whole body the matter of the seede, as we haue shewed before in the fourth booke,

But in women although their originall be the same, yet they fall not out of the *Peritonæum*, neyther do they reach so farre as to the share-bones, but beeing supported with fat membranes are disseminated part of them vnto the Testicles, part vnto the bottome or soale of the wombe.

More-

Moreouer they affoord slender surcles to the Rimme of the belly and to the coats which inuest the Testicles.

Lumbares. The fourth vessell that departeth from the lower trunke, is called *Lumbaris* or the *Loyne-veyne*. They are two [tab.5, m mm] or three arising from the lower part of the trunk, which is next vnto the spondels betweene foure rack-bones of the Loynes, & they passe through the holes made for the out-gate of the nerues in the sides of the racke-bones. Their vse is to water and nourish the spinall marrow.

Their vse.

Hippocrates. From these two veynes on each side one ascends into the braine at the side of the spinall marrow which haply are those whereof *Hippocrates* maketh mention in his booke *de Genitura*, and it may be they bring a portion of the matter of the seed down frō the brain, whereof *Aristotle* in his Problemes was so confident that he sayth it hath beene seene.

After the departure of these foure veynes the Trunke descending vnto the *holy-bone* [Tab.5, n] at the fourth rackebone of the loynes inclineth vnder the great artery, [Tab.5, charact.14,] that it might neyther be hurt by the hardnes of the bone, nor offended by the continuall motion of the Arterie, and is diuided into two equall branches called *Rami Iliaci* or the *Illiack* branches which resemble the letter A or Y inuerted, which run obliquely aboue the haunch and the share-bones vnto the legge. Out of these on eyther side before the diuision do issue two veynes. The first is called *Musçula superior* [Tab.5 n p n p] the *vpper muscle veyne*, which ariseth euen in the very diuision frō the vtter side of the branch, sometime it issueth out of the trunke of the hollow veyne before the partition, and is transuersly or ouerthwart disseminated through the muscles of the Loynes of the *Abdomen* and through the rim of the belly; but their originall is not the same on both sides; & in dogs it is more manifest then in men. The second is called *Sacra*: [tab.5, ° °] or the holy veyne. It is but small, somtimes single, somtimes double, and it is conuayed through the vpper and forward holes of the hollye bone to nourish his marrow.

The Iliacke branch.

Musçula superior.

Sacra.

Afterward the Illiacke trunke on eyther side in his progresse [Tab.5, r] is bifurcated into a vtter branch, [Tab.5, s] and an inner, [Tab.5, t] and the latter is smaller then the former: from the inner branch proceed two veynes.

Musçula media The first is called *Musçula media* [Tab.5, f f f] the *middle muscle* veyne. It is the outward propagation of the inner branch, and is deriued transuersly [Tab.5, r] with many surcles into the muscles of the thigh which occupy the vtter part of the hips, into the skin of the buttocks, and into the neighbour parts.

Hypogastrica. The second is called *Hypogastrica*, [tab.5, au] the veyne of the water-course. It is the inner propagation of the interior branch. A notable veyne it is and sometimes double, & is diuided manifold, because it was to be distributed for the nourishment of al the parts almost in the *Hypogastrium* or Water-house. One part of it runneth vnto the muscles of the right gut, and maketh the outward Hemrod veynes by which somtimes an abundance of thinne blood, falling hether out of the hollow veyne, is auoyded without payne or torments of the belly; sometime also without paine in the Fundament, wheras the blood that issueth from the internall Hemrods made by the branch of the Gate-veyne is alwaies paineful in the auoyding. Another part runneth out in men vnto the bladder with great & large surcles, into the neck, I say, of the bladder and into the yard. But in women it is but a little lengthened, & beeing sustained with a fat membrane it disperseth some surcles into the bladder but many more into the lower part of the wombe and the necke thereof, by which oftentimes in womē with child, & as some say in Virgins the courses are auoided.

The outward Hemrod.

That which remaineth of his interior branch passeth on vnto the share-bone and assumeth vnto it selfe a little rillet from the external branch, which together make a veine [Tab.5, y] which perforateth the Rim of the belly, and after also the tenth muscle of the thigh, and goeth through the hole of the share-bone.

From the vtter branch of the byfurcation of the Illiack trunke, [ta.5, p] which attaineth obliquely vnto the thigh do issue three veynes: two before it fall through the *Peritonæum*, and one after.

From the outward.

Epigastrica. The first is called *Epigastrica*, [ta.5, char.1 & 2] It issueth from the vpper part of the vtter branch: somtimes also but more rarely from the Crurall, and offereth branches to the rim of the belly and to the muscles and skin of the *Abdomen*. The chiefe branch of this veyne piercing through the *Peritonæum* runneth vpward on both sides vnder the right Muscle distributing diuers small branches into the transuerse and oblique muscles and about the Nauill is ioyned by some surcles to the Mammary veyne that descendeth thether, by which *Bauhine* thinketh that notable consent is made betwixt the breasts

breaſt and the wombe, for thoſe Veines haue their originall from the ſame deuiſion, from whence thoſe other haue it which attaine vnto the wombe and the boſome thereof. For their endes or extremities ioyne with the extremities of the *Mammary* veines which deſcend through the capacity of the cheſt, and runne as farre as to the middle of the right Muſcles, and in their deſcent doe ſend branches through the diſtances of the griſtles vnto the roots of the Pappes.

The ſecond is called *Pudenda*. [Tab.5.char.15.] It ariſeth from the inſide of the outward bow after it hath gotten ouer the *Coxa*, and fallen into the thigh, and perforated the *Peritoneum* or Rim of the belly. It reacheth ouerthwart to the middle of the ſhare bones, and is diſtributed with a wonderfull increaſe, in men into the *Scrotum* or Cod, and into the skinne of the yard, in women into the place of modeſtie, and the neighbour parts. *Pudenda.*

The third and laſt is called *muſcula inferior* [Tab.5 char.13.] *the lower muſcle veine*. It iſſueth from the outſide of the vtter branch Tab.5.c.] and running through the ioynt of the hip, is diſſeminated into the muſcles and skin of that place. Muſcula inferior.

The reſt of the propagations which iſſue from both the trunkes [Taq.5.ρ.ς] becauſe they bee no longer called Iliacke but Crurall veines, wee will intermit till the tenth Chapter.

CHAP.VI. *Of the aſcending Trunke of the hollow veine.*

WE diuided the hollow veine into a Deſcending and an Aſcending trunke; the Deſcending we haue proſecuted in the former chapter, the Aſcending we take now for our taske.

The hollow veine therfore after it hath paſſed through the nervous part of the midriffe, on his right ſide by a hole of purpoſe for it paceth on through the Cheſt with his trunk vndiuided [Ta.6.fig.1.from A to D. Ta.7.from B to H.] ieuen to the *Iugulum*, that is, the hollowneſſe aboue the coller bone. It is a larger trunke then the Deſcending, for it was to leade blood vnto more parts, and for more ſecurity is ioyned to the midriffe, and to the right *deafe eare* of the heart. *Laurentius* ſaith it toucheth the *Mediaſtinum* likewiſe. In men there is queſtion whether it do or no; *Veſalius* is againſt it, but in Dogges and Apes, ſayth *Bauhine*, it doth without doubt. And leaſt in the *Iugulum* it ſhould be hurt by the hardneſſe of the bone, and alſo that it might more ſafely be diuided into notable branches; there is a glandulous body couched vnder it called *Thymus*, in calues it is called the *Sweete-bread*. In Dogges and Apes (*Galen* ſaith alſo in men) a lobe of the Lungs is layde vnder it betweene the Purſe of the heart and the midriffe, for their cheſts are longer then is a mans. The Aſcending trunke.

Before the diuiſion there iſſue out of the trunke foure branches.

The firſt is called *Phrenica* [Tab.7.C.] or the veine of the midriffe, one either ſide one, which is diſſeminated through the midriffe in many ſurcles, and ſendeth ſmall branches to the *Pericardium* or purſe of the heart, and to the *Mediaſtinum* or partition of the cheſt. The right of theſe iſſueth ſometimes within the cauity of the cheſt; the left ariſeth out of tht trunke vnder the midriffe, wherewith alſo ſometimes the Fatty veine called *Adipoſa* is ioyned. Preſently the trunke of the hollow veine pacing one and perforating the *pericardium*, and inclining a little to the left hand [Tab.7. aboue B.] maketh a brode *ſinus* or boſome before the hart ouer againſt the 8 rackbone of the cheſt or the top of the ninth; ſomtimes in the middle ſpace which is between the ſeuenth and the eight racks. VVhere changing almoſt his ſubſtance and his roundneſſe it degenerateth in the right deafe eare, [Tab.7.D.] of the heart; or if you will it is on euery ſide faſtened to the right eare which it ſuperficially embraceth. There it is infixed into the right ventricle of the heart, not penetrating very deepe, to the end it might poure blood into it as into a Cyſterne. *Phrenica.* His faſtning to the heart.

Euſtachius ſaith that there is a certaine membrane ſet to the fore and inner ſide of the hollow veine, which at the middle of the perforation determineth into many fibres, which being diuerſly complicated doe make vp or fulfill the reſt of the ſemi-circle, and without coniunction are ſpread ouer the whole perforation, that ſo the ſame membrane might be put forward and repelled backeward by the matter that ruſheth in or out. But this membrane ſometime wanteth that texture or fibres, and reſembleth the forme of the Mitred or horned Moone, as it is in the crowne veine. It is alſo ſometime ſo ſmall and narrow that, as if it were not all, it is vndeſcryed; which haply, ſaith *Bauhine*, is the reaſon that I haue not yet obſerued it. Euſtachius his value.

The

Coronaria cordis.

The second branch which issueth from the thumbe before the diuision is called *Coronaria Cordis* [Tab.6.fig.2.[B]. tab.7.[E].]the crowne veine of the heart, for, because it compasseth the basis of the heart, like a crowne or garland, the Grecians call it στεφανιαῖα. It sendeth many brãches through the vtter surface of the heart all ouer the bowell from the basis downeward vnto the *Mucro* or poynt, especially through his left side, for, because the substance of the heart is there the thickest it stood in need of more plentiful Aliment, and because it required a thicke nourishment conuenable or agreable to his substance, therefore it receiueth bloud by this veine before it get into the ventricle, where the bloud becomming thinner is destined for the nourishment of the Lungs.

His value.

At the originall of this Crowne-veine there is placed a value or flood-gate like a halfe Moone, resembling that which in the heart of the Infant is set before the first *Anastomosis* or inoculation. This Value keepeth the bloud that is once allowed to the Surface of the heart that it flow not back into the hollow veine, being shaken by the continuall motion of the heart. This *Crowne-veine* (sayth *Galen*) is sometimes double; one on the backside, another arising from the foreside.

When the hollow veine hath allowed this garland to the heart it perforateth the purse thereof againe, and againe resumeth his round figure and becomming much lesser forsaketh the Rack-bones, because vpon them the Gullet and the rough artery doe leane, and runneth through the middest of the lungs where the right part is separated from the left, vpward vnto the *Iugulum* aboue the *Thymus*.

But that the Racke-bones and the spaces betwixt the ribs might not be destituted of Veines; it yeildeth forth a trunke or notable veine aboue the heart as it were in the verie middest of the body.

The veine *Azygos.*

This veine which is the third before the diuision of the Trunk is called *vena* ἄζυγος, or *sine pari*, the Veine without a companion, which we haue before called the *non-parill*. [Ta.6. fig.1.C fig.2.B fig.4.B] The reason is because commonly in a man it is but one as also in a Dogge hauing no mate on the other side. It ariseth aboue the heart betwixt the fourth and fift Racke-bones of the Chest, out of the hinder [Tab. 6.fig.4. A] and lower part of the hollow veine as it regardeth the Rackes, but rather to the right hand then to the left.

Vesalius taxeth *Galen* very deeply for inconstancy and irresolution concerning the originall of this veine, to all whose obiections *Bauhine* maketh answere, wherwith we could willingly make you acquainted, if we did not thinke that such altercations are fitter for other palats then we desire to be Cook vnto.

In Dogges after the originall it sinketh directly downward to the sides of the Rackes, but in men it goeth not directly, but is reflected a little to the right hand and backeward toward the spine aboue the right trunke of the rough Artery. When it hath touched the rootes of the Rack-bones it is lifted vp, and passing on to the midst of them it descendeth downward, so that aboue the eight or ninth Rack-bone of the Chest it is in the very middest, and runneth downeward vnder the Artery, which beareth vppon it as farre as to the end of the Chest (but deuided before) and with the great Artery peirceth thorough the Midriffe. In most creatures, in which I woulde haue young men exercise themselues, it taketh his originall from the left side of the hollow veine, and descendeth (sayeth hee) through the cauity of the Chest on the left side; which indeede in Sheep is alwayes true, but in those creatures which chew the Cud in whome it is double, (which in men is very rare, vnlesse you will say it may bee so in those that bee Ambidexters, that is, can vse both hands alike,) the right occupyeth the rootes of the ribbes on the right side, and the lefte the rootes of the ribbes on the left side.

The veine described by *Falopius.*

In like manner sometimes as we are taught by *Falopius* [ta.8.i] there is found in men on the left side another veine [Ta.8.i] which performeth the office of the *Azygos*, & then the other on the right side paceth neare the roots of the ribbes, but ariseth not aboue the middle of the racke-bones.

[*Table 7.is the same with Table 6.lib.7.Folio* 445.]

This last Veine taketh his originall from the *subclauian* branch, and affoordeth small furcles to some of the spaces betwixt the ribs, & sometimes at the fift rib is vnited with the branch which from the Trunke of the *non parill* is sent ouerthwart [Ta.8.[ee]] to the left side ouer against the sixt Racke of the Chest, from which also a small braunch ariseth vpward. Sometimes it ariseth not from the *subclauian* branch, but out of the Trunke of the hollow veine

veine before his deuiſion againſt the third Racke-bone of the Cheſt, and ſendeth ſmall branches vpward to the two firſt ſpaces betwixt the ribs. His other ſurcles it affordeth to the lower ſpaces of his owne ſide, as farre as to the ſixt Rackbone, whether when it hath attayned, it is ioyned with the foreſaide tranſuerſe branch, from which ſurcles are ſprinkled into the reſt of the diſtances betwixt the ribs.

Commonly from the trunke of the veine *Azygos* ([Ta.6.fig.4.[B] tab.7.[FF] ta.8.[d]] which is ſeated as it were in the middle of the body; out of the backward Region, I ſay thereof, as well on the right hand as on the left but from the right eſpecially, branches are diſtributed to the diſtances of the ten lower ribs, [Ta.6.fig.4.] ſometimes but rarely to all the diſtances of the ribs, and thoſe branches are called *Intercoſtales* [tab.7.[gg]] paſsing along in the diſtances of the true ribs as farre as to their griſtles: but in the diſtances of the baſtard ribs they run out to the muſcles of the *Abdomen*. The *Intercoſtall* veines.

It diſtributeth alſo an aboundance of ſmall branches to the Gullet; ſometimes and that not ſeldome, when it ariſeth from againſt the fourth racke-bone of the Cheſt, it ſendeth a branch vpward, [tab.8. at the vpper [d]] from which ſurcles are deriued with a wandring paſſage to the foure vpper ribs.

The propagations of the *Intercoſtall* veines doe fall alſo out of the Cheſt, [Ta.8.xxx] and on both ſides in ſome places are vnited by inocculation [Tab.8.[yyy]] with the ſurcles of the lower *Cheſt-veine*. VVhence it is that in the *Plureſie* we doe not alwayes vſe, as *Veſalius*, to open the veine on the right ſide, but finde it profitable to Phlebotomize the inner veine of the cubite on the ſame ſide the paine is. But becauſe of this vnion, revulſion is made more commodiouſly and more eaſily.

When the Trunke of the Veine *Azygos* hath attayned to the eight and ninth ribbe, ſometimes to the tenth ſayth *Hippocrates* in his book *de natura oſsium*, it is deuided aboue the Spine into two boughes: a right and left, which *Falopius* and *Euſtachius* did firſt obſerue, [Ta,6.[c]] both which doe creepe downeward and paſſe through vnder the diuiſion of the Midriffe. 2. boughes of the *Azygos*.

The left.

The one of theſe, and for the moſt part the greater, on the right hand determineth moſt what with one branch into the backeſide of the hollow veine, neare the beginning of the Emulgent. Sometimes into the middle of the Emulgent, [Ta.8.[ef]] where it bringeth forth the Seede-veine. Sometimes againe it is reflected in the cauity of the backe, and vnited againe with a ſmall branch yſſuing from the Emulgent. Sometimes alſo this left branch is deuided into 2. branches, one of which runneth vpward [ta.6. fi.4.[E]] the other downward by the roots of the ribs, & affordeth branches to the diſtances betwixt thē.

The right bough approaching to the hollow veine, is ſometime ioyned thereto aboue the Emulgent, ſometimes it is ioyned to the Emulgent it ſelfe, but that rarely: Sometime to the firſt veine of the Loynes, but moſt commonly it is implanted into the laſt [Ta.8.*] of the Loynes. VVe alſo finde in ſome bodies a ſmall branch running obliquely by the Racke-bones, and penetrating or making way into their cauity. VVhereupon wee conclude, that in the beginning of a *Pleureſie* the Veine of the Hamme or that of the Foote called *Saphena* may be opened. The right.

Hence alſo it is that many *Pleuriticke* Patients are critically purged, Nature auoyding an aboundant quantity of *Pus* and *Matter* by the vrine. Moreouer it hath beene obſerued that in thoſe which we call *Empyici*, the *Matter* hath beene conuayed through the venall Artery of the Lungs into the left ventricle of the Heart, thence into the great Artery, and ſo into the Kidneyes, and continually auoyded by the vrine. VVherefore this diſtribution of the Veine *Azygos* and his vnion ſheweth howe the Cheſt may commodiouſly be purged by the vrine. The Rackbones alſo along which it runneth and the *Mediaſtinum* receiues ſurcles herefrom. How the cheſt is purged by vrine.

Nowe whereas *Amatus Luſitanus* in his Centuries, and with him *Hollerius* affirme that the beginning of this veine hath Membranes or Flood-gates, ſuch as are found in the orifices of the veſſelles of the heart which admitte the ingreſſe of the bloud out of the hollow veine into this *Azygos* but hinder the egreſſe; they are much deceiued ſayeth *Bauhine*: for I could neuer obſerue any ſuch eyther in men or in bruite beaſtes. Adde hereto that if you open this *non-parill* below, preſſe it out and put a bugle thereinto, when you blow the bugle, not onely this veine but the hollow veine alſo will ſwell. Their opinion therfore falleth to the ground, who think that when a veine is opened in the arme, thogh the hollow veine be emptyed, yet there is no depletion made out of the *Azygos*, becauſe No values in the *Azygos*.

though thoſe values do hinder the egreſſe of the blood into the hollow veyne.

Intercoſtalis ſuperior. The fourth veine that ariſeth out of the trunke before the diuiſion is called *Intercoſtalis ſuperior*, the vpper Intercoſtall veine. [Tab.6, fig.1 [r] Tab.7, [x]] There is one of them on each ſide ariſing from the ſubclauian branch neare the beginning of the Iugular veyne. [Tab. 7, [s t].]

Sometime the right veyne ariſeth from the trunke, and the left from the branch. It is reflected vnder the Artery of the arme, and for the moſt part eſpecially on the right ſide is diuided into two branches which are diſtributed ſomtimes into two, ſometimes into three diſtances of the vpper ribs which are ioyned with the mammary branches [Tab. 7, [ll]] which creepe through the griſtles This veyne is then wanting when the *Azygos* affoordeth branches vnto all the diſtances of the ribs.

In like manner from all the Intercoſtall veynes there iſſue certaine ſmall ſurcles which inſinuate themſelues into thoſe holes of the rack-bones, out of which the nerues do iſſue for the nouriſhment of the bones and the ſpinall marrow.

The diuiſion of the trunke. The trunke of the hollow veyne beeing deliuered of theſe veſſels [table.7, [n]] aſcendeth directly vnder the breſt-bone aboue the great artery at the Iugulum, where it is ſupported by the *Mediaſtinum* and the *Thymus*, and is diuided into two notable bowes, [Tab.7, [ll] tab.8, [cc]] one of which runneth to the right ſide, the other to the left, and as long as it remaineth in the Cheſt it is called Subclauius. *Columbus* and *Falopius* call it *Axillaris*.

Table 8 is the ſame with Table 7, Lib.6, folio 363.

The ſubclauian branches. From each ſubclauian branch ſome veynes iſſue from the lower part, ſome from the vpper. From below before the ſubclauian is diuided do ariſe foure veynes or branches.

Mammaria deſcendens. The firſt is called *Mammaria deſcendens* [tab.6, fig.1, [rr] tab.7, [ll] tab.8, [l]] *The deſcending mammary veine* whoſe originall is diuers, for ſometime it ariſeth frow the fore and middle part of the byfurcation, ſometime from the roote of the ſubclauian, ſometime the left ariſeth from the ſubclauian and the right from the byfurcation. Sometime there is but one which ariſeth out of the middle of the trunke of the hollow veyne before the diuiſion, which when it hath attained vnto the breſt bone is diuided into a right and a left.

This mammary veine inclining forward and running vnder the breſt-bone, getteth out againe at the ſides of the griſtle, which we called the breaſt-blade, and creepeth along the vpper part of the *Abdomen*, allowing ſurcles thereto, and in his deſcent affoordeth ſmall branches to all the griſtly diſtances of the ribs (for the bony diſtances are ſupplied by the *Azygos*) which are ioyned with the extremities or end of all the intercoſtall veynes. A part of this mammary veine getteth out of the Cheſt and to the muſcles that lye therupon and when it hath diſtributed his ſurcles part vnto the paps, part vnto the reſt of the breſt, it is led downeward vnder the right muſcles of the *Abdomen*, to which his branches are tyed and the extremities of his diuiſions do vnite [Tab.7, [m]] with a ſmall Epigaſtrick veine [ta.7, [g]] which aſcends vpward. Other ſmall veſſels alſo run vnder the skin to the *Hypocondria*, which veſſels are made partly of the commixtion of the Intercoſtall veynes with the mammary, partly of thoſe which nouriſh the Intercoſtall muſcles, with which alſo others are vnited which aſcend from the groyne vpward.

Mediaſtina. The ſecond veyne iſſuing from the ſubclauian before his diuiſion is called *Mediaſtina* [Tab.2, lib.6, [c]] which ariſeth from the trunke, ſometimes from the left ſubclauian againſt the internall Iugular. Sometime it is but one veyne and that large deriued downeward aboue the hollow part of the Lungs and aboue the purſſe of the hart, and is diſſeminated thorow the *Thymus* and the *Mediaſtinum*. Sometime they are two ſurcles which runne through the *Mediaſtinum*, one of which is ioyned with the aſcending veynes of the Midriffe, the other paſsing downeward with the left nerue of the midriffe, is inſerted into his fleſhy ſubſtance, and this inſertion is better perceiued in young bodyes then in Auncient.

Ceruicalis. The third veyne is called *Ceruicalis*, [Tab.6, [oo] Tab.7, [nn]] or the necke-veine. It is not very large, and runneth obliquely vpward and backeward by the laterall proceſſes of the racke bones of the necke, and paſſeth the holes made in them, affoording ſurcles to the muſcles that lye next vppon the bones. It ſendeth alſo others through the holes made for the nerues to nouriſh the marrow of the necke, and ther is conſumed. *Laurentius* thinketh it aſcendeth vnto the braine.

Muſcula inferior. The fourth is called *Muſcula inferior*, [Tab.7, [o]] the lower *Muſcle*-veyne which ſome-

ſometime yſſueth out of the externall Iugular, and is diſtributed through the vpper muſcles of the breaſt and the lower of the necke. And theſe foure iſſue from the *ſubclauian* branch before it get out of the cauity of the Cheſt. Afterwards when it is gotten out of the Cheſt [tab.8 [p]] it changeth his name and is called *Axillaris*. From the axillary veyne before it be diuided, two veines are propagated.

The firſt is called *Scapularis interna* [Tab.7.[q]] the inner blade veine and is diſtributed through the muſcles on the inſide of the blade, and thoſe that are neare them, where alſo thoſe ſmall branches doe appeare which paſſe through the glandules that are vnder the arme pits. *Scapularis interna.*

The ſecond is called *Scapularis externa* [tab. 7.[d]] the vtter blade veine, becauſe it paſſeth into his gibbous and vtter part: the other part of it runneth betweene the fleſh and the skin. *Scapularis externa.*

Afterward the axillary branch is diuided into two veines, [tab.6.[n] tab.7.[a m]] one ſuperior which is called *Cephalica*, [Tab.7.[a] tab.8.[q]] or the head veine. The other inferior [tab.7.[m] Tab.8.[r]] called *Baſilica* of both which we ſhall ſpeake in the ninth chapter. In the meane time you ſhall know that from the trunke of the *Baſilica* two veines doe iſſue. *Cephalica. Baſilica.*

The firſt is called *Thoracica ſuperior* [Tab.7.[z] Tab.8.ſ.] the vpper cheſt veine, which applyeth it ſelfe to the breſt, and is diſtributed into the skin and the muſcles which couer the breſt: in women it yeeldeth a great number of veines vnto the dugs. *Thoracica ſuperior.*

The ſecond is called *Thoracica inferior* [Tab.7.[x]. tab.8.t t.] the lower cheſt veine. It runneth all along the ſide of the cheſt and his branches are inoculated [Tab. 8.yy] with the branches of the veine *Azygos* [tab. 8.[x x]] which iſſue out of the cheſt (wherefore we may draw blood in a pleuriſie out of the axillary veine of the payned ſide) and are diſtributed through the broade muſcle of the arme. This lower cheſt veine ariſeth ſometimes out of the vpper, ſometime out of the *Baſilica*. And thus much for the veines ariſing from the lower part of the *ſubclauian* branch. *Thoracica inferior.*

From the vpper part of the *ſubclauian* branch ariſe three veines on each ſide. The vpper muſcle veine and the two Iugulars, one externall another internall, which aſcend vnto the ſides of the necke, and at whoſe orifices there are two values which hinder the relapſe of the blood, for otherwiſe the vpper parts ſhould haue beene defrauded of Aliment.

The firſt I ſayde was called *Muſcula ſuperior*, [tab. 7.[b b], tab, 8.[o]] the vpper muſcle veine. It ariſeth neare the externall Iugular [Tab.8.[n]] and is diuerſly diſperſed into the skin and muſcles that are on the backe ſide of the necke. *Muſcula ſuperior.*

The ſecond is called *Iugularis externa* [tab.6.fig.1,[l l] tab.7.[r r]. tab.8.[n]] the externall Iugular veine. It is one commonly on each ſide, yet ſometimes double from the originall ſometime it groweth double in the middeſt of his paſſage. It runneth vpward vnder the skin affoording ſurcles to all the outward parts of the necke, of the head and of the face on his owne ſide, and for the moſt part vnder the roote of the eare it is diuided into an vtter and inner branch, as we ſhall ſay in the next chapter when wee ſpeake of the veines of the face. *Iugularis externa.*

The third and laſt is called *Iugularis interna* [tab.6, fig.1,[k k] tab.7.[r r] tab.8.[m]] the internall Iugular veine. In man becauſe of the aboundance of his braine it is greater then the externall, but in Dogs leſſe. At the ſide of the rough artery, it ſendeth ſmall ſurcles therto and to the neighbour membranes, thence it climeth vnto the chops, and hard at the head is byfurcated or diuided, and there we leaue it. *Iugularis interna.*

CHAP. VII. *Of the veines of the Face the Eyes, the Noſe, the Teeth and the Throttle*

WE ſayd euen now that the externall Iugular veyne was vnder the roote of the Eare diuided into an vtter [tab.7.[y]] and an inner branch. [x] The inner runneth to the muſcles of the mouth, the chops, and the bone *Hyois*. In the mouth it maketh thoſe two notable veins vnder the tong [tab.7,[t]] which from their colour rather then from their figure are called *Raninæ* the Frog-veines which veins in diſeaſes of the mouth, the heate of the throate and the ſquinſie are opened for deriuation after euacuation and reuulſion made by the vaine of the arme. From it alſo are many ſurcles deliuered ouer to the Larynx or throttle, to the glandules thereto growing and to all the parts of the chops for their nouriſhment. Afterward approa- *Raninæ.*

ching to the skull it entreth thereinto through a hole of the temple bone neare the mammillary proceſſe and ſo goeth into the *ſinus* of the *dura mater*. There alſo paſſeth a vein on the outſide of the orbe of the eye, by the hole of the wedge bone which is likewiſe diſſeminated into the *dura mater*.

The vtter branch.

The vtter branch creeping vp the skin, and the muſcles of the head vnder the eare is ſupported with Glandules, and diuided with two propagations. One of which runneth to the foreſide of the face [tab.7ᶻ] and is allowed to the noſe and the puffe of the cheeke and in the middle of the forehead it is ioyned with the branch of the other ſide, and maketh the veine of the forehead [tab.7 æ] which in ſome caſes is wont to be opened. *Vena Frontis* Another propagation thereof runneth by the ſide of the head, and ſprinkleth veines partly to the temples [tab.7, æ] partly to the Nowle of the head. [tab.7 *] The branches of this exterior veine are diuerſly mixed in the face and the ſides of the heade: from which ſome ſmall ſurcles are diſtributed into the ſutures of the ſcull and the ſmall holes or perforations thereof. And ſo much of the externall Iugular, now we come vnto the internal, where we left it at his bifurcation hard at the Head, in the end of the chapter going before.

CHAP. VIII. *Of the Veynes diſſeminated through the Braine.*

The inner Iugular.

THE inner Iugular veine when it attaineth on the backſide to the Baſis of the Scul, is diuided into two branches wherof the one which being the larger is carried backward, the other which is the ſmaller is carried forward.

The firſt of the Braine.

The firſt is led along the baſis of the Scull with the leſſer branch of the ſleepy artery, and when it hath affoorded ſurcles to the Muſcles which lie vnder the gullet, it getteth into the ſcull and ſo into the *ſinus* of the *Dura mater*, through the firſt hole of the Nowle-bone which was prepared for the ſixt paire of ſinewes.

The ſecond.

The ſecond which leaueth the ſleepy Artery, ruuneth forwarde after it hath ſent a ſurcle to the organ of Hearing through the fourth hole of the Temple bone, it entreth into the ſcull by the ſeuenth hole of the Wedge-bone and walketh through the baſis and the ſides of the *Dura mater* or thicke membrane leading them Aliment, becauſe they are far diſtant from the third *ſinus*: from theſe alſo do yſſue ſome ſurcles which creepe vppe the *Pia Mater*.

The third.

Bauhine accounteth the third veine of the braine to bee the inner branch of the externall Iugular which diuideth it ſelfe into three ſurcles, and entereth into the ſcul by the hole of the temple-bone which is neere the Mammillary proceſſe, of which wee ſpake in the former chapter.

The 4 and 5.

The fourth and the fift Veynes of the Braine he ſaith do proceede from the ſame interiour branch of the externall iugular, the fourth entreth into the ſcull out of the orb of the eye by the ſecond hole of the VVedge-bone, the fift out of the capacity of the Noſethrils by the hole of the *ſciue* or ſpongy bone. The vſe of theſe two latter Veins is to nouriſh the fore-part of the Braine, becauſe vnto it the third *ſinus* dooth not reach but determineth neere the diſtinction of the Mammillary proceſſes. Theſe Veynes alſo becauſe they are ſmall haue no Arteries ioyned with them, yet there is a ſurcle ſent thither from the firſt artery of the Braine.

Veſalius and Platerus add a ſixt.

Beſide theſe fiue Veines *Veſalius* and *Platerus* affirme, that there is another which they call *The firſt Veine of the Braine*, which is the end of the *Neck-veine*. For when the Neck-veine commeth vnto the top of the necke that which remaineth of it, together with the Artery his companion, paſſeth through the third hole of the Nowle-bone, which poſtern was particularly made for this priuat vſe: or if that be wanting through the ſecond, which was made for the ſeuenth paire of ſinewes, and determineth on both ſides into the ſinus of the *Dura Mater*.

Falopius.

Bauhine ingenuouſly confeſſeth, that he could neuer finde this paſſage & yet makes mention of it, becauſe other men ſhould not want occaſion to enquire after it. For ſaith he, the Necke-veine is partly conſumed or taken vp in the perforations of the rackbones of the necke, yet ſo that it touch not the firſt racke: partly his braunches are diſſeminated into the backſide of the neck, hauing firſt tranſmitted ſomevnto the Muſcles in that place as we are taught by *Falopius*, which Veynes are vnited together among themſelues, and together alſo with others which are ſent out of the *ſinus* of the *Dura mater*, through the large hole of the ſcull, for there are many veines which from the *Dura Meninx* are propagated to the outſide of the head through the Sutures comming from without: which ſaith

Falopius

Falopius gaue occasion to some to thinke that they were outwarde veines which went in through the holes of the Scull into the *sinus* of the *Dura Mater*, whereas they are rather internall Veines which get out at those holes and are ioyned with the externall.

The vse of the veines of the Braine which are in innumerable multitudes disseminated into both parts thereof and into his marrow (and although some of them be so final, that he which is not quick-sighted cannot perceiue them, som of them conspicuous enough) the vse I say of them all is three-fold. The first to minister vnto the Braine his Aliment, that is Blood, and that in great aboundance, because the quantity of the Braine is great. And truly that there is abundance of Blood in the head dooth easily appeare in dissections after inflammations of the Braine. *The vse of the Veynes of the Braine.*

Their second vse is to transmit vnto the braine naturall spirite from the Liuer for the nourishment of the Naturall spirit which is in the Braine.

The third, that together with the naturall spirit the naturall soule, which is called also *Vegitatiua* or the growing faculty, might be conducted into the braine, for because in the braine there is a faculty to draw, retaine, concoct and expell the Aliment or superfluities thereof, it is very necessary that it also should haue in it the Naturall Soule either of it selfe or deriued from other where. But because the seate of the naturall soule is concluded to be in the Liuer, it must needs follow, that it can no otherwise be conueyed to the braine but through the veines. *Archangelus.*

Archangelus addeth a fourth vse of these veines of the Braine, and that is, that by the veines as also by the Arteries, the seede might be made fruitfull. For *Hippocrates* sayth in his booke *de Genitura*, that those are barren and vnfruitfull whose Veines behinde their eares are cut or diuided, and his reason was because he thought that a great parte of the seede fell neere the eares from the head into the spinall marrow. But if the passage bee stopped vp by a Cicatrice growing vpon the wound of the vessell, then shall the current of the seede be interrupted.

Concerning which difficulty and the interpretation of *Hippocrates* meaning, wee haue disputed at large in the fourth question of the fift booke, and therefore we will not trouble the reader heere with fruiteless repition, but send him thither if he desire to bee further satisfied concerning that matter.

Beside the veines and other vessels of the braine. It hath a priuate vessell which is called the *sinus* of the hard membrane; full of blood, but beating like an Artery, into which three Veynes and two Arteries do powre their matter, which sinus according to the diuers course and inclination thereof is diuided into foure sinus: greater indeede then the veines that attaine vnto the scull and more capacious, not round but triangular. The whole sinus consisteth of three ribbes all of equall longitude, and of the fourth part of a circle incurued. From these do arise branches or passages like vnto veines, and doe distribute blood as well Vitall as naturall into the substance of the braine. But because wee haue entreated sufficiently hereof in our chapter of the membranes of the braine which is the seauenth of the seuenth Booke, where also we haue exhibited the figure therof vnto you, wee will heere put an end to the veines of the Brain, and passe on vnto the veines of the Arme. *The sinus of the Braine.*

CHAP. IX. *Of the Veynes o the whole Hand in the large Acceptation.*

WE sayde before that the Trunke of the Hollow-veine vnder the breast-bone at the very *Iugulum* or sticking-place [Ta. 9. fig. 1 [n]] is diuided into two notable branches, [[1]] one of which runneth to the right hand, the other vnto the left, and as long as it is within the Chest it is called *Subclauius*, but after it is gotten out because it runneth to the arme-holes it changeth his name and is called *Axillaris*, from which diuers Veynes do yssue, of which we haue spoken before: but the Axillary veine departeth into two branches, one vpper which is called *Cephalica* [a] or the Head-veine, the other lower which is called *Basilica*, [m] so that both of them haue the same Original, and of both of them will we intreat in this chapter. *The trunk of the Hollowe-veine.*

The *Cephalica* or head-veyne [a] is the vpper branch of the *Axillary*, but it issueth from the externall Iugular veyne. It is called *Cephalica* because it is wont to be diuided or opened in diseases of the head. It is also called *Humeralis* or the veine of the arme, because by the arme it discendeth vnto the hand. It is also called the *Outward* veine, because it runneth on the outside of the Cubit. For passing along by the top of the arme it runneth vnto the cubit and the hand betwixt the fleshy membrane and the coate of the muscles, *Axillaris. Cephalica.*

and before it hide it hide it selfe vnder the arme it sendeth out sometimes one, sometimes two little branches [dd] which are distributed through the muscle of the arme called *Deltoides* and the skinne wherewith it is couered: then it passeth to the outside of the Cubit in which very place some make the beginning of the *Cephalica* veine, and call that part aboue it the *Humerary* veine. There also it is very conspicuous euen without section, except the man be eyther too fat or haue small veynes. But in the descent, there issue from it small veynes as far as to the ioynt of the Cubit or the elbow, partly directly, partly creeping obliquely into the muscles of the arme and into the outside of the skin, so that sometimes it seemeth to vnite it selfe [f] with the branch of the *Basilica*, which is distributed likewise in the skin.

The diuision of the *Cephalica*.

Sometimes a branch is sent to the inner muscles of the Cubit, which branch in men is most commonly wanting: but when it commeth vnto the ioynt or bow of the Cubit, [ff] it is diuided neare the externall protuberation of the arme into an inner and an outward branch.

The inner branch.

The inner at [h] being led along vnto the middest of the bent of the Cubit vnder the skinne ioyneth or vniteth it selfe with a branch of the *Basilica* at [f] & so maketh that veine which is called *Mediana* or the middle veyne at [a]. But sometimes this branch is scarce cōspicuous, whereas the veyne opposite proceeding from the *Basilica* is very manifest, and sometimes it is quite contrary.

Mediana.

The veyne called *Mediana* [a] hath his name from his situation, and it is also called *Communis* or the Common veyne, because it is formed of branches of the *Cephalica* and *Basilica* running both into one [b] This coniunction is made commonly in the verye bought of the arme, sometimes much lower not far from the middle of the length of the Cubit, and by *Auicen* is called *The blacke-veyne*. It runneth obliquely downward through the middle Region of the arme, and aboue the *Wand* sprinkleth surcles on eyther hand, sometimes also it assumeth others from those which runne through the inside of the Cubit. But aboue the *Radius* or *Wande* [below ß] it is diuided into two [γε] branches. The vtter [γ] sendeth a surcle marked with [Δ] to the inside of the wrest toward the Thumbes, and is mingled with others. [ηζ] The remainder runneth out toward the Region of the thumbe and forefinger which some call *Saluatella*; but commonly the Chyrurgions call it *Cephalica* by others *ocularia*. The inner branch [ε] is spent in many surcles betweene the the fore and middle fingers, and some deale into the ring finger.

Some thinke this to be that which *Auicen* calleth *Syele*. But the truth is, that the distribution of the veynes which run vnder the skin of the hand is so diuers, yea in the Cubit it selfe, that the same mans right arme doth scarce agree with his left, but two men alike you shall not finde among a great many, and therefore their declination is harder to score out.

The vtter branch. *Funis Brachij*

The vtter branch of the *Cephalica* by *Auicen* called *Funis Brachij*, the Chord of the arme [γ] goeth obliquely by the *Wand* into the length of the Cubit on the outside, sprinkling small veynes as he goeth [k] into the skin. But when it hath attained vnto the middle of the wrest on the inside neere to the *vlna* or *Ell* [γ] there is ioyned to it a smal branch of the *Basilica* [χ] wherewith being increased it climbeth ouer the outside of the wrest, & with a small branch entangleth that part of the hand which lyeth before the ring and the little fingers, and maketh that veyne which the Arabians call *Syele*, we commonly *Saluatella*, which in the backe of the hand appeareth before the fingers. The section of this veyne in the left hand is held by the Arabians and by many other Practitioners in phisicke to be of great auaile in melancholy diseases. Sometime this branch of the *Cephalica* is wanting & his stead is supplied by a brāch of the *Basilica* [χ] which runneth throughout the length of the Ell, sometime it is supplied by branches issuing from the *Mediana* into the skinne.

Saluatella.

Basilica.

The lower branch of the Axillary veine is called *Basilica*. [Ta.9.mm] It is greater and larger then the *Cephalica*, and deuided into more surcles, many call it *Axillaris*, the veine of the Arme-hole, some the *inner veine of the cubit*, because it descendeth by the in-side of the cubit.

Hepatica.

Amongst practitioners it changeth his name in respect of the Arme, for in the right arme it is called *Hepatica* or the Liuer-veine, because it is opened in diseases of the Liuer. In the left Arme it is called *Lienaris* or the Spleene-veine, because it is opened in diseases of the Spleene. It passeth along the inside of the arme among the muscles which compasse the bone, and at the Arme pit is entertayned by many Glandules, where also it

Lienaris.

is

Table 9. Figure 1. sheweth the Cephalica *and* Basilica *Veins & their branches.*

TABVLA IX.

FIG. I.

FIG. II

H The by-partition of the hollow veyne vnder the breast-bone nere the *Iugulum*.

I, The subclauian veine, on either hand, aboue I the vtter and inner Iugular veine, with that which is called *Cerui̇calis* or the Neck-veine.

K, the vpper intercostall veine.

LL, the Mammary veine.

O. *Muscula*, which goeth to the lower muscles of the neck and the vpper of the Chest.

P, A vein which reacheth vnto the muscles that lie vpon the Chest vnto the skin of that place, and vnto the dugges.

Q, A veine that goeth vnto the backside of the chest to the hollow part of the blade & to the neighbor-muscles.

* Small veins to the glandules vnder the Arme-pits.

R, A branch distributed along the sides of the Chest, especially into the broad muscle.

a, the Humerary veine called *Cephalica*.

b, A branch vnto the backewarde muscles of the necke.

dd, Branches from the *Cephalica* to the muscle that lifteth vp the arme.

ee, Small veines out of the *Cephalica* dispersed through the skin of the arme, & the muscles that leade the arme backward.

f, A threefold diuision of the *Cephalica*. *g*, The first branch to the muscles arising out of the externall protuberation of the arme. *h*, A branch of the *Cephalica* which helpeth the *Median* veine. *i*, the third branch of the *Cephalica* running obliquely aboue the *Wand*. *k*, Sureles that run vnto the skin from this 3 branch. *l*, The third branch at the wrest ioyned with the branch of the *Basilica* noted with *x*, their coniunction is at *l*. *m*, The veine called *Basilica*. *n*, *o*. A branch running by the heads of the muscles of the cubite at *n*, also branches to the muscles themselues at *o*. *p*, A notable branch of the *Basilica* carried obliquely and accompanied with the fourth nerue. *q*, The diuision of the *Basilica* into two branches, and that which is noted with *q* is alwayes accompanied with an artery. †, The deepe branch of the *Basilica* bipartited or diuided into two. *r*, The other branch that goeth to the flesh and the skin. *s*, A branch of this to the skin of the arme. *t*, That branch of the *Basilica* which with the *Cephalicall* branch *h* maketh the *Median* veine at *cc*. *u*, A branch of the *Basilica* going to the inner head of the arme. *xx*, A braunch out of the former going to the wrest, and toward the little finger ioyning it selfe with the *Cephalica*. *y*, A branch nourishing the skin at the outside of the cubit. *zz*, The vpper z sheweth a propagation out of the branch of the *Basilica* marked with *t*. the lower z another out of the *Basilica* branch at *x* running to the inside of the arme. *cc*, The Common veine called *Mediana*. *β*, the partition of the *Median* veine aboue the wrest, but the *β* is set a litle too low. *γ*, *δ*, The outward branch heereof going to the outside of the hand at *γ*, from which ysseth a small branch vnto the inside of the hand at *δ*. z, Another branch towardes the middle and ring Fingers. *ϕ*, The veyne of the Thumbe which nourisheth the Hillocke or mountenent which ioyneth with the veyne noted with *δ*.

is diuided into diuers propagations: the most noble whereof is disseminated into the muscles which lye vpon the chest, and of these againe the largest called *Thoracica inferior*, [Ta. 9.k] the lower chest veine, runneth neare the ribs and receiueth the rootes of those veines which ysse out of the chest, and whereby wee sayde before the distances betwixt the ribs were nourished: or to speake playner, the mouth of the veine *Azygos* doe ioyne in three branches sometime in foure on each side with the mouth of the chest-veine. Ta. 8. xxxx with yyyy.]

Hence any man may gather what veine is to bee opened in a *Pleurisie*, that is to say, whether the veine on the side inflamed or on the contrary side.

It

It ſendeth alſo a ſmall branch vnto the Muſcles which extend or ſtreatch the cubit, Tabl.9.[n] againſt which another veine is diſperſed from his oppoſite into the Glandules. From the ſame backeſide another veine [Tab.9.°]is ſent to the ſame muſcles,from which ſome ſurcles are ſprinkled into the skinne of the Arme on the outſide. Vnder this a notable propagation [Ta.9.[p]] runneth obliquely downeward vnder the bone of the Arme to ward the outward protuberation together with the fourth nerue of the arme.

The diuiſion of the *Baſilica*

Afterward this *Baſilica* not farre from his egreſſe out of the cauity of the Cheſt,is diuided into two trunkes[Tab.9.fig.1.[q r]] and thoſe almoſt equall, one of them is called the Deep veine,the other the *Cutany* or Skinne veine. The Deepe veine becauſe it lyeth or

Profundus.

lurketh in the bottome is called *Profundus* [q]or the trunke which lyeth low. It is faſtned to the Axillary Artery which runneth into the arme[ta.9.fig.2.[x]] and their diſtributions are almoſt alike. It is alſo accompanied with the fourth branch of the third nerue of the arme,and deſcendeth through the middeſt thereof vnder the *Median* or common veine,

His diuiſion.

and when it hath ouercome the ioynt of the cubit;[t.9.*]it is diuided into an vtter and an inner brãch,which receding or departing a litle one from another,& ſprinkling ſurcles in to the muſcles,do deſcend together with the tendons of the muſcles of the fingers vnder the tranſuerſe ligament,and are diſtributed into the inſide of the fingers.The vtter,which deſcendeth along the *Radius* or wand lendeth 2.ſmal branches to the thumbe & the fore-finger,and one to the middle finger. The inner is tyed to the bone of the cubit and is deuided alſo into two; and from theſe one branch is afforded to the middle finger and 2.to the Ring &little fingers. The firſt to the muſcles of the outſide of the hand the 2.to thoſe on the inſide.

Subcutaneus.

The other trunke of the *Baſilica*[ta.9.[r]]is called *ſubcutaneus* or the skin-veine, becauſe it runneth immediately vnder the skin throughout the length of the arme on the inſide,and in his paſſage diſperſeth many branches; afterward a little aboue the inner protuberation of the arme where it is no leſſe conſpicuous before diſſection thẽ the *cephalica* is aboue the

His diuiſion.

cubit; it is diuided into a forebranch [ta.9.[s]]and a hinder branch.[t.9.a little aboue [u]]The fore branch running obliquely through the middle of the bought of the cubit,maketh together with the inner branch of the *Cephalica* [ta.9.[h]]vnder the bent,the Common veine. [ta.9.[a]]Yet ſometimes this branch which runneth vnto that common-veine is farre larger or leſſer then the branch of the *Cephalica*,ſometimes alſo either of them are double. The poſterior branch of the *Skin-veine* [ta.9.[u]] is diuided into two neare the inner protuberation of the arme,[vnder [u]]and the vtter and greater of theſe [* *] deſcendeth along the *vlna* or Ell vnto the wreſt,and ſendeth a branch downward [**] neare the wreſt vnto the little finger,and againe meeteth and ioyneth [[t]] with another branch of the *Cephalica* [[t]]paſſing that way,and this after the manner we haue before ſpoken of is diſtributed into the outſide of the hand.From this branch alſo a ſurcle is diſſeminated vnto the skin [[y]]and the backparts. There are alſo other branches [the lower [z]]yſſuing out of this propagation [[u]] diſſeminated into the skin of the inſide, which branches are diuerſly mixed now vniting themſelues,againe departing one from another,aſſuming ſurcles from the propagation noted with [*]and communicating others vnto it.

Finally,from that branch of the *Baſilica* [Ta.9.[t]] which maketh the *Mediana* or common veine,out of the lower and middle part thereof yſſueth another notable veine[at the

Burſten veins in the arme.

vpper [z]] which deſcendeth ſometimes directly ſometimes with a crooked paſſage vnto the wreſt,and is diuerſly vnited with other neighbour veines. Hence it is, ſayth *Veſalius*, (and the obſeruation was worthy of the Authour) that ſometimes the inſide of the cubit is troubled with broken or bodden veines as the calfe of the Leg is. The ſurcles of that notable veine ſometimes directly or in a right line,ſometimes ouerthwart,ſometimes obliquely, ſometimes againe vnited and ſometimes diuided,doe growe vnto the skin of the inſide of the hand.

An idle curioſitie.

From theſe ſo diuers coniunctions of veines,eſpecially when the beginnings of the *Cephalica* and the *Baſilica* is one and the ſame [Ta.9.[m n] out of I] we may eaſily gather how vnprofitable a thing it is to be ſo ſcrupuluos and anxious in the choice of veines in one & the ſame ſide of the arme: wherefore when wee are reſolued to open a veine,and a veine of the arme,as alſo on which ſide it ſhall be performed,it will be out of doubt the beſt to ſtrike that veine which vpon the binding of the arme will bee moſt turgid and full. For there are three places to let bloud in the arme, according to *Galen* in his Booke *de curatione per ſanguinis miſſionem*,the interior,the exterior and the middle. VVherefore when

we

we come to open a veine we finde all three places equall or two only, or all vnequal: sometime also one of them is hidden and sometimes two. The section of the inner veine he esteemeth profitable for those that haue any affection in the lower parts of the neck. The section of the vtter veine when the superior partes as the face and the head are diseased. The section of the middle veine communicateth with both, for it is compoũded of veines yssuing on both sides. *Galen.*

To conclude, there are found in the *Cephalica* and *Basilica* certaine values, but I containe my selfe, for because we shall meet with them also in the Foote, I thinke it best to referre their description vnto the end of our discourse of the veines. The Values.

CHAP. X. *Of the Veines of the whole Foote in the large acception.*

THE hollow veine in the lower Belly descending vnto the Holy-bone, when it commeth vnto the fourth racke-bone of the Loynes, where it lyeth vnder the great Artery [Table. 10. O] is deuided into two equall trunkes: one of which goeth to the right Legge, the other to the left, which trunkes before they get out of the *Peritoneum* are called *Iliaci*, Ta. 10. betwixt O and G] and presently both the right and the left bones are subdiuided into two branches, [Ta. 10. ρ ς] an interior and an exterior, f om which diuers propagations are dispersed, as we haue before touched in the eight chapter of the third booke.

From thence it beginneth to be called *Cruralis* or the veine of the Leg, [Table 10. ε] and after the externall braunch [ρ] hath attayned with two boughes vnto the bone of the Legge. It passeth the share-bone [ι] and sendeth a surcle vnto the *Cup* of the Hippe to be disseminated into the Muscles of that place which compasse the inside of the Thigh, and so a branch of it runneth vnder the skinne of the Thigh on the same side. Presently after it is ioyned [χ] with the internall crurall branch [char. 2.] and so ceaseth. But because in that place toward the lower part of the bought of the Thigh, there is a cauity wherein the braunch of the hollow veine was to bee deuided into many propagations, that those propagations might be more firmely secured, there are many Glandules dispoſed round about, which also are a defence to the Nerue and the Artery that descend that vvay with the Veine. *Crural.*

From the *Crurall* branch [tab. 10. °] which is the trunke of al the rest of the Veins that run into the Legge and yssueth from the outward branch [tab. 10, ᶜ] of the trunke of the Hollow veine, there yssue on either side six branches. Diuision of the crurall veine into six branches.

The first is called *Saphæna* or the branch of the *Ankle* [ϑ] which is a notable and verie long Veyne. It runneth together with a Nerue fastned vnto it through the inside of the legge betwixt the skin and the fleshy panicle vnto the knee and so on towarde the inner ankle, and is diuersly diuided into the top of the foote towarde the Toes, especially toward the great Toe where it is mingled with other Surcles sent from other Veynes into that place. 1 *Saphene.*

From this branch commonly there are foure propagations sprinkled through the skin. The first is double, one interiour [ʌ] which being yet in the groyne sendeth on either side branches to the inside of the Thigh, to the groine it selfe and to the rim of the belly. The other exterior [ξ] and larger then the former, determining into surcles which are sent into the foreside and outside of the Thigh. 4 ptopagations.

The second propagation at the middle of the legge [π] reacheth to the first muscle of the *Tibia*.

The third is rowled orbicularly backward at the knee, and one part of it goeth to the skin of the whirle-bone, [ϱ] the other into the Ham: and this branch is altogether vvanting when the Veine of the Ham is a little larger then ordinary [Char. 6] or if it bee not wanting it is exceeding small and slender.

The fourth departeth with surcles forward and backward at the middest of the *Tibia* [Tab. 10 from φ to Ψ] which surcles do diuersly vnite themselues with the Veines that are next vnto them, & are againe parted asunder. Sometimes from the inner part of the *Tibia* vnder the foreside of the Ankle it is reflected and runneth vnto the vpper side of the foote [Ψ] and is distributed almost into all the Toes of the foote; but the surcles aboue the foote and at the Toes doe differ much. For in some bodies it is mixed with other braunches, and runneth out vnto the little finger: sometimes it runneth towardes the Thumbe and the forefinger; wherefore scarse any man hath the same distribution of the

Veines

Table 10 *Sheweth the distribution of the hollow veyne into both the feete.*

TABVLA X.

O, The diuision of the hollow veyn at the fourth spondell of the loynes aboue the holy-bone into two Iliack trunkes, which diuision is like the greeke letter Λ.

σ *Muscula superior* disseminated throgh the muscles of the loynes, of the *Abdomen* and the *Peritonæum* or Rim of the belly.

ϱ σ, the byfurcation of the left Iliack trunke into an exterior branch at σ, and an interior at ϱ.

τ *Muscula media*, a propagation of the branch ϱ into the outward muscles of the thighes and the skinne of the Buttocks.

χ, the meeting of the branch ϱ with the veyne of the second branch.

υ, the passage of the branch ϱ through the hole of the share-bone.

G, the Crurall veyne which is the stocke of the veynes that go into the leg.

Γ, *Epigastrica*, A propagation of the branch σ carried vpward to the muscles of the *Abdomen*.

ΔΔ, *Pudenda*, A propagation of the branch σ, which runneth ouerthwart to the Genitals.

Θ, the veyne of the Ankle called *Saphæna*.

Λ, The interior branch of the *Saphæna* going to the inside of the thigh, to the groynes & the *Peritonæum*.

Ξ, the vtter and greater branch of the *Saphæna* going into the fore-side and outside of the thigh.

Π, the second branch of the *Saphæna* to the first muscle of the leg.

Σ, the third branch of the *Saphæna* rowled orbicularly to the backside of the knee.

Φ, the fourth branch of the *Saphena* which runneth vnder the skin through the inside of the leg and is distributed into diuers surcles. And this branch may heere be opened.

Ψ, this branch should haue gone downe as far as char. 7.

Ω, *Ischias minor*, A propagation of the exterior branch σ vnto the muscles that sit vppon the ioynt of the hippe and to the skinne of that place.

1, *Muscula*, the vtter and lesser branch heereof runneth vnto the 2 and 4 muscles of the leg. 2, the inner and greater branch of the *Muscula* distributed through the muscles of the thigh, especially the fist & the third of the leg. 3,4,5, Two crurall branches 3,4, meeting together; surcles passe at 5 backward to the skin of the thigh, and descende through the middle of the Hamme. 6, *Poplitea*, the hamme-veyne, which veyne the Antients did often open. 7, Small branches from the hamme veyne which runne through the skin of the Calfe vnto the heele. 8, *Suralis* or the Calfe-veyne. It is diuided at the lower side of the thigh into an exterior trunke, 9, and an interior, 14. 9,10, The vtter branch of the sural veyne at 9, distributing a smal branch outward into the skin of the knee. 11, the diuision of the externall surall branch vnder the knee into an inner brãch 11 going betwixt the muscles of the foot. 12,13, And an vtter which runneth throgh the outside of the leg vnto the outward ankle & the vpper part of the foot in diuers surcles. 14,15,16, the inner sural branch 14 running through the backside of the leg, a branch of the same through the inside of the leg at 15, which descendeth to the heele and the great toe at 16. 17,18, *Ischias maior* issuing from the inner branch of the surall veine at 14, and passing vnto the muscles of the Calfe. From this a great branch 18 is distributed into the vpper side of the foot and the toes passing downeward betwixt the muscles of the leg. 19, The remainder of the inner trunk, 14 which runneth behind the inner ankle, and is consumed into the toes. 20, The coniunction of the externall surall branch with the branches of the *Poplitæa* or the hamme veine.

veynes in both his feet, the same number and the same magnitude.

This veyne Physitions vse to diuide in the diseases of the wombe, especially in the retention of the courses about the ankle.

The second branch of the Crurall veyne is called *Ischias minor* [Tab. 10, Ω] and is opposite to the former, for as that is the inner branch of the Crurall trunke, so is this the exterior.

terior. It is but a ſhort veyne and is diſſeminated outward and ouerthwart into the fore-skinne of the ioynt of the hip and to the muſcles of that place.

Afterward the trunke it ſelfe paſsing from the groyne is drenched among the muſcles which compaſſe the bone of the thigh, and ſhooteth out of it ſelfe the third veyne

The third veyne is called *Muſcula*, [Tab.10, char.1.] and is double, ſometimes they anſwere one another. The vtter and leſſer of theſe [char.1,] parteth with ſurcles to the ſeconde and fourth extending muſcles of the *Tibia* and into the skin. The inner and the greater [char.2,] which alſo lyeth deeper, is diuaricated or diuerſified through all the muſcles almoſt of the thigh, eſpecially the fift and the third extender of the leg, and at length aſſumeth the end of that veyne [s] which runneth through the hole of the ſhare bone into the thigh, wherewith being increaſed, but lurking ſtil betwixt the muſcles it deſcendeth vnto the knee. But the greateſt veyne called *Cruralis* [°] in the middle of the thigh, is by degrees writhen backe-ward and offers ſmall ſurcles to the membranes of the nerues that deſcend vnto the leg. Afterward it parteth with the fourth veine. *Muſcula.*

The fourth veyne is called *Poplitæa* or the Hamme-veyne, which is made of two crurall branches vnited. [char.3,4,] From this in his originall, certaine ſurcles are ſent backward and vpward into the skin of the thigh, [char.5,] afterward it falleth directly vnder the skin through the middeſt of the bent of the hamme [char.6,] as farre as to the heele. [char.7, the lower] Sometimes it deſcendeth to the skinne of the outward ankle, ſometimes alſo of the inner, from which in his progreſſe he ſprinkleth many ſmall branches vnto the skin of the Calfe, ſome right, ſome oblique and ſome tranſuerſe vnequally commixed & vnited together. Sometimes wee meete with it ſimple and ſingle, and ſometimes this *hamme-veyne* [char.3,] aſſumeth vnto it ſelfe a branch from the veyne which is ſent to the fift muſcle of the thigh, [char.2,] and being ioyned therewith it runneth out into the skin on the back ſide of the thigh, and ſendeth ſome ſurcles vpward. And this is the veyne which the Ancients vſed to open vnder the knee. The fift veyne of the Crurall branch is called *Suralis* or the Calfe-veyne. The great veyne of the legge at the lower end of the thigh, after it hath ſent ſmall branches back-ward on eyther ſide, [at char.8,] into the originall of the three muſcles which make the Calfe, it is in the hamme diuided into an exterior and an interior trunke. The exterior [character 9] after it hath diſtributed a branch [character 10,] obliquely outward toward the connexion of the *Brace* with the *Leg*-bone into the skinne on the fore-ſide of the knee, is preſently vnder the knee diuided into two branches; an interior [character 11,] which deſcendeth with the Brace among the muſcles of the foote, and it endeth where their fleſhy part determineth, for it attaineth not to the skinne: and an exterior, [character 12,13,] which running along the out-ſide of the legge to the outward ankle and the vpper part of the foote attaineth to the skinne, but the skin on the outſide. *Poplitæa.* *Suralis.* His diuiſion. The exterior diuiſion.

It diſtributeth alſo (as did the *Poplitæa*) [char.7,] diuers ſurcles, and mingling it ſelfe [character 20,] with the ſurcles of the *Poplitæa*, eſpecially in the toppe of the foote which they call the *Backe*, it maketh that knarle of veynes which is ſeene in the vpper part of the foote vnder the skinne.

The Interior [character 14,] deſcending directly through the backſide of the legge looſeth a branch [character 15,] from his inſide, which paſsing along by the inſide of the *Tibia*, is diſſeminated vnder the skin vnto the inſide of the heele and the great toe, [char.16,] and is vnited to the ſurcles that are there-about, and afterward againe diuided from them as we haue ſaide before that other veynes do. The interior.

And this ſurely is the reaſon why in this part ſo often there are *Varices*, that is, burſten or bodden veynes. But this vnion and diuiſion or diſtraction afterward of the veynes was neceſſary, leaſt when the skinne is offended and ſome veynes cut ouerthwart the skin that bordereth vpon it ſhould be deſtituted of nouriſhment. Wherefore becauſe in the legge in three or foure places the internall veynes are vnited with the cutany veynes or veynes of the skinne, eſpecially in the foote if you purpoſe to open one of them that lye next vnder the skinne there is no reaſon you ſhould be very ſcrupulous in your choice, as if they were peculiar veynes deriued from diuers parts or bowels of the body, for they are all ptopagated from one and the ſame trunke. Note this.

The Interior trunke [char.14,] when it hath ſent foorth the fore-ſaide branch, [char.15,] runneth deepe and produceth the ſixt veyne.

The ſixt and laſt veine is called *Iſchias maior*, [char.17,] the greateſt part wherof deſcen- *Iſchias maior.*

ding

ding through the Muſcles of the Calfe caſteth on each ſide ſmall ſurcles, and when it attaineth to the ſeparation of the bones of the leg from the Brace-bone, it ſhooteth out a great propagation [ch.18] from his forepart, which hauing perforated the membranous Ligament runneth among the Muſcles which occupy the forepart of the *Tibia*, and in his deſcent affoordeth ſurcles to the neighbor-muſcles; and when it is paſt vnder the tranſuerſe ligament is diſtributed in the vpper part of the foote, but ſo as it is diuided into his Muſculous ſubſtance, and ſo giueth to each toe two ſmal branches. And this veine in the Sciatica and other affections of the Hip is vſually opened about the outward ankle; and *Falopius* giueth vs his word, that it is of great auaile though he relye more vppon experience then vpon any great reaſon.

That which remaineth of the interior branch [char.14] runneth into the backeſide of the foreſaid muſcles and ſo attaineth to the ſole of the foote, where it is conſumed into many ſmall branches which run by courſes. Two of them creepe along the inſide of each toe; ſometimes the little toe hath fiue, the next to it two, the middle toe one.

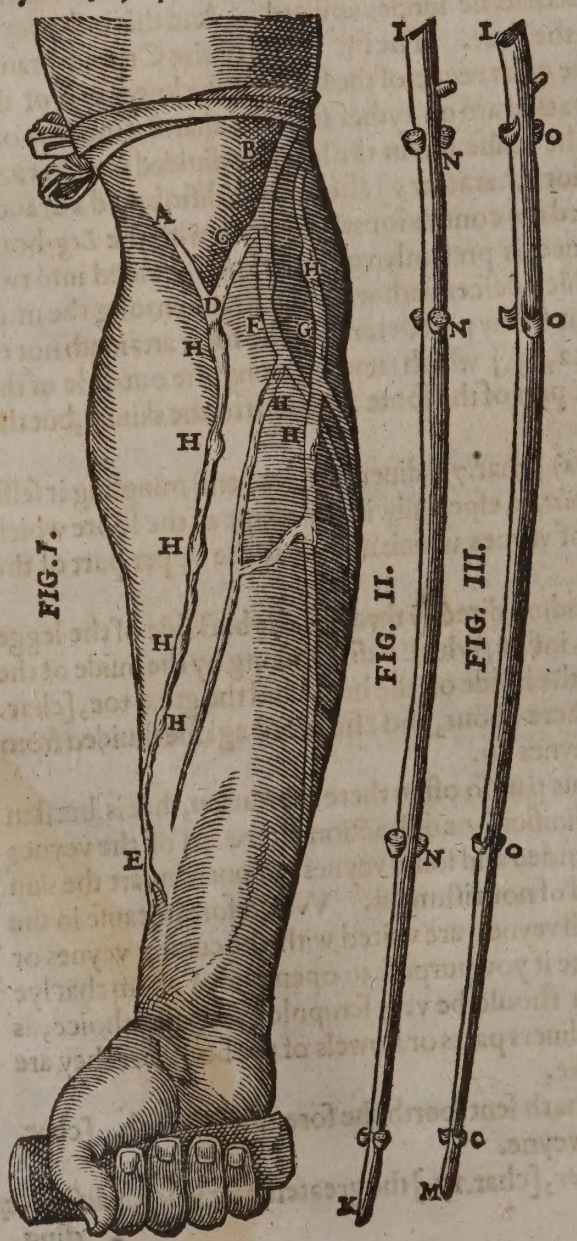
And thus haue we brought to an end the Hiſtory of the veines thoroughout the vvhole body. Now we ſhould paſſe on vnto the arteries, ſauing that wee promiſed in the end of the laſt chapter to ſay ſomewhat of the values which are found in the veines, which promiſe I will now acquite my ſelfe of.

CHAP. XI. *Of the Values or Flood-gates of the Veynes.*

Auicen. OF theſe Values *Auicen* the *Arabian* ſeemeth to haue made the firſt mention, calling them *Cels in the Veynes*. *Hieronimus Fabritius ab Aquapendente* an excellent Anatomiſt of *Padua* in *Italy* made publique demonſtration of them in the yeare of Grace 1574. and wrote a Tractate of them in the year 1603.

Aquapendens.

Salomon Albertus. *Salomon* alſo *Albertus* ſhewed them in the yeare 1579. and wrote of them in the yeare, 1584.



Tab. xi. Figure. 1. ſheweth the arme bound ready for blood-letting.
Fig. 2 & 3. ſheweth two Veines of the legs turned the inſide outward.

A. A branch of the *Cephalica* Veine making the *Median* veine.
B, C. The *Baſilica* B and a braunch of it making the *Median* at C.
D. The *Median* Veine made of the branches of the *Cephalica* and *baſilica*.
E. The *Median* Veine being caried through the middeſt of the Cubit diuided aboue the *Radius*.
F. A deepe trunke of the *Baſilica* or the trunke lying very low.
G. The trunke of the *Baſilica* lying vnder the skin.
HHH. Values in the veines of the arme.
I, K. The firſt veine of the Leg.
L, M. The ſecond veine of the leg.
NNN. The values filled with bumbaſt.
OOO. The values empty.

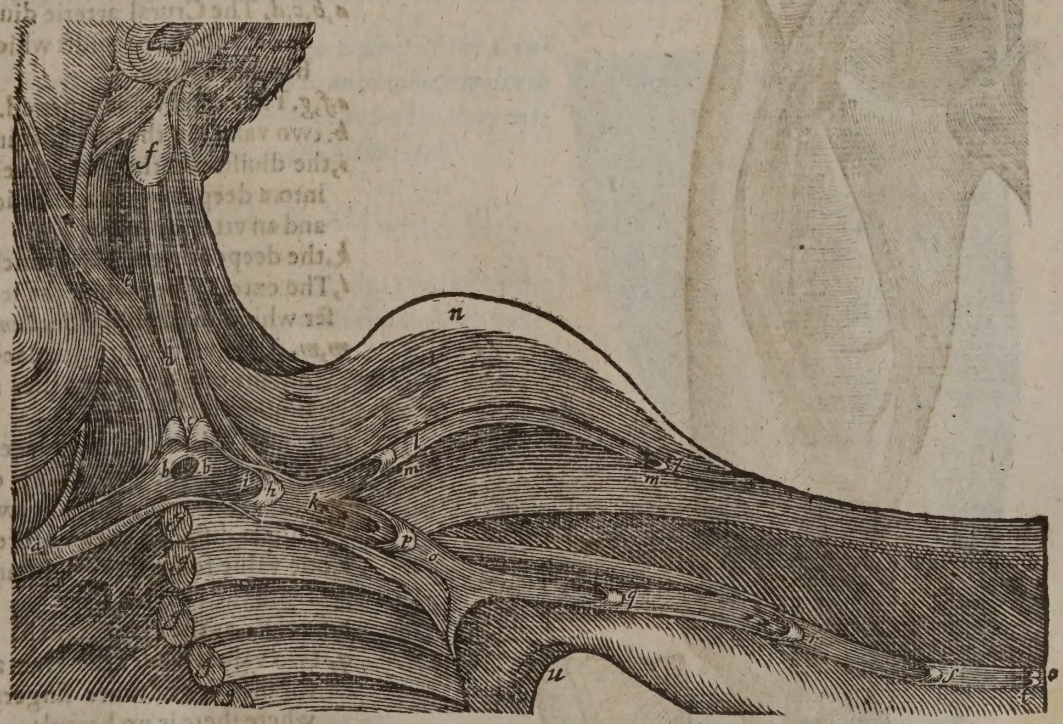
The Values are found in the Veines of the ioynts, and are nothing elſe but ſmall portions of the coate of the veines ſtarting in their cauity, and intercepting the one halfe thereof, making in them as it were an angle or corner: wherefore the body of the veine is no where ſo thin as where theſe ſmall membranes do depart from it. Some men had rather call them *Oſtio'æ* then *Valuulæ*, which word we do not better know howe to Engliſh then to call them *Floodgates* which ſtoppe and intercept the currents of waters. What a value is.

They are ſeated in the veines of the armes and the legges aboue and below after the Glandules of the arme-pits and the groine. Preſently vnder the originals or out ſhootings of the branches which are diſſeminated from the ſides of the veins into the neighbor parts for their nouriſhment. And the reaſon why they were created was, that the blood which is to be diſtributed to other partes, might in that place make a ſtay and not be carried in a full ſtreame along the large or direct Canale or pipe, and from the leſſer branches, and thoſe that are propagated obliquely be defrauded. Their ſituatiõ And vſe.

They reach from the ſides of the veynes vnto the middle of their capacity: neither do they ſhut vp the orifices of the braunches where they take their beginning out of the hollow veine, but are rather diſpoſed in the branches themſelues, for otherwiſe there could haue bene no regurgitation of humors which is very neceſſary as wee are taught by reuulſions. But in the orifice of the Iugular veine there are found two Values, leaſt when the head is reclined too much backward the blood ſhould violently ruſh into the braine. Where they are found.

The Trunke of the Hollow-veine in the lower and middle Region, as alſo that of the Artery hath no Values, that without any obſtacle or oppoſition the blood might bee euery way diſtributed as well for the reſtauration of the ſubſtance that vaniſheth or waſteth away, as alſo for the generation of ſpirits. In like manner an innumerable number of ſmall externall veynes are all together without them.

TABVLA. XII. *ſheweth the values almoſt in the middle of the arme at the originall of the Inner Iugular veyne.*



a, The ſubclauian veyne.
bb, The orifice of the veyne betwixt the inner Iugular and the Axillary veyne.
c, Two values at the originall of the internall Iugular. *d*, The internall Iugular opened.
e, The diuiſion thereof nere the head.
f, The Glandule vnder the eare.
ggggg, fiue ribs cut off.
h, Values at the Axillary veine.
i, The axillary veine produced from the Subclauian.
k, The diuiſion of the axillary vein into the *Cephalica* and the *Baſilica*.
ll, The *Cephalica* called alſo *Humeraria*.
m, *m* Two values in the *Cephalica* fiue fingers almoſt aſunder.
n, The muſcle of the arme called *Deltois*.
oo, The *Baſilica* veine called alſo *Hepatica*.
p, *q*, *r*, *ſ*. Foure values, the firſt is foure fingers of the ſecond, the ſecond three from the third, the third two fingers off the fourth.
t, Two values ioyned together in the *Baſilica*.
u, The Arme-pit or the hole vnder the arme.

The number of theſe Values is vncertain and the diſtances betweene them very vnequal, yet commonly they are double or two together, vnleſſe it be little aboue the Tranſuerſe Ligaments which containe the Tendons of the hands, the feete, the fingers & the toes. Alſo when a large veine beginneth to be contracted there moſt commonly they begin to be fewer till at length they vaniſh quite away. For where it is fit that more blood ſhould be ſtopped and ſtopped longer there are two Values; where leſſe and for a ſhorter time there one will ſerue the turne eſpecially there is but one where a leſſe veſſel is obliquely produced out of a greater.

Their diſtãce. For the diſtance betweene them, although they runne throughout the length of the veſſell, yet in ſome places there is two fingers, in ſome three, in ſome foure, in ſom fiue fingers diſtance between them. As for example, in the *Cephalica* vnder the Muſcle called *Deltoides*, there are two Values about fiue fingers diſtant one from another. In the *Baſilica* as it runneth through the inſide of the arme there are foure large Values. The firſt is foure fingers diſtant from the ſecond, the ſecond three from the third, the third two from the fourth, after which follow two ſmall Values ioyned together.

In the *Cephalica.*

In the *Baſilica*

So in the foote (I meane the foote in the large acceptation) in the Hollow veyne before it be ſubdiuided in the groine there are two great values ſet, afterwards when it is diuided into a greater and a leſſer trunke, the greater in two places hath two values foure fingers diſtant one from another. Thence downeward at the Ham one, at the calfe two, then one, and finally two other. But in the leſſer trunke there are more, for in the beginning of the byfurcation there are values; within the diſtance of two fingers two more;

In the Veines of the Foote.

TABVLA. XIII. *ſheweth the Crural veine and Artery, as alſo all the leſſer branches of the Crural veyne opened.*

a,b,c,d. The Crural arterie diuided through the midſt which hath no values.
e,f,g. The crural veine opened.
b. two values in the crurall veine
i, the diuiſion of the crurall vein into a deeper or greater brãch and an vtter or leſſer.
k, the deeper or greater branch.
l, The exterior branch or the leſſer which maketh the *Saphæna.*
m,m, Two values in two places diſtant one from another about foure fingers.
nnn, Two values in three places, the firſt in the beginning of the bifurcation, the 2 at two fingers diſtance, the 3 at three
o, one value foure fingers diſtant from the two laſt.
p, 2 values at the Ham branch.
q, two values vnder the Ham at the diſtance of foure fingers, where there is no branch.
r, One value, three fingers diſtãt from the former.
, One other value foure Fingers diſtant from that.
t,u. The veine *Saphæna.*
x, A value 5 fingers diſtant from the former.
y, 2 values at the wriſt of the foot
z, A value three fingers diſtant from the former.
a, The laſt value of the *Saphæna,* for that which remaynes hath no Values at all.

and two and

others three fingers off; likewiſe in the ſame veine making the *Saphena* there is one value; foure fingers off of that two, and vnder the hamme foure fingers off likewiſe two more; three fingers off theſe there is one, and another foure fingers off it; fiue fingers off that another, two vnder the wreſt of the Foote; three fingers off them one ſingle one, and after the ſame diſtance appeareth the laſt; the remainder of the *Saphena* runs without values vnto the top of the great Toe.

Their poſition

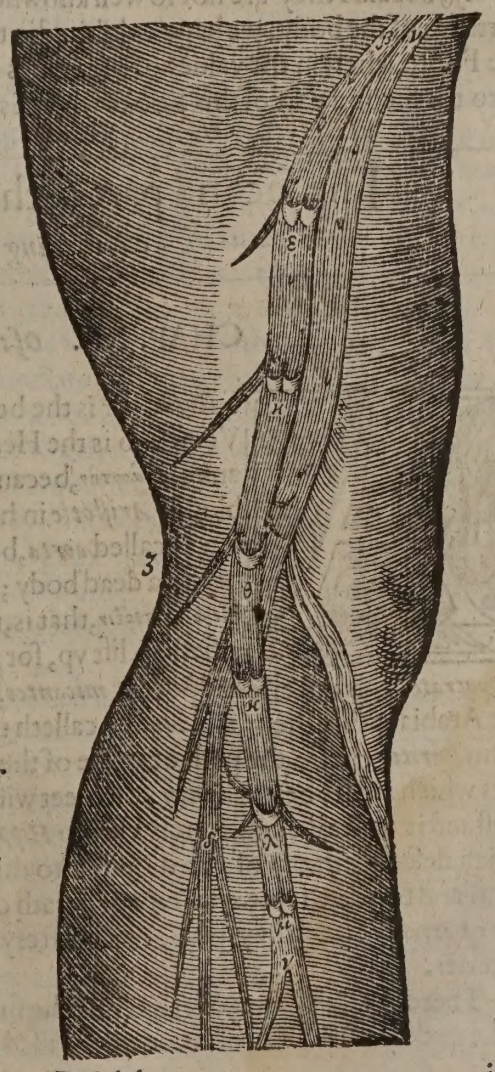
But becauſe the ſtronger current and courſe of the bloud might bee better abated, theſe values are not placed in a right line or alwayes on the ſame ſide, for then the whole ſtreame of bloud would haue flowed downe that ſide of the veſſell that is free: Wherefore they vary their ſeate very artificially, as if in the vpper part of the veine there be two values, then after the diſtance which wee ſayde was betweene them, other two values appeare in the lower part of the veine, ſo that the hornes of the following membranes doe regard the middle and embowed part of thoſe that went before and on the contrary, yet ſo that in the middeſt they doe not touch one another, but leaue a tract or path whereby the bloud may paſſe downward and fall as well into the lower values as into thoſe aboue. So then the lower values ſtay that bloud which eſcapeth from the vpper, & yet the courſe of the bloud is not intercepted.

Their figure.

The figure of a Value ſayeth *Aquapendens*, is like the nayle of a mans finger, or they be like a horned Moone, on their outſide they repreſent the knottes that are in the branches of plants, for when a mans arme is tyed to let him bloud, there appeare within certaine diſtances as it were knots on the outſide, and in clowniſh bodies ſayth *Bauhine*, they may be ſeene to ſwell in the outſide of the Legges like a *Varix* or a burſten veine. And truely a *varix* is nothing elſe but a veine and his value dilated by thick bloud which is detayned in the value, for without theſe the veines would bee dilated and ſwell equally in euery place.

Vpward toward the rootes of the veines theſe values are open, but below and at the ſides they grow to the veines, for they are portions of their coate. And if you put a quill

Table 14. *ſheweth the values of the Crurall veine and his deep branch which walketh along with the Arterie, and theſe values may here be ſeene as far as the bifurcation.*



TABVLA XIIII.

β, The deeper braunch of the *Crurall* veine which muſt bee tyed with the branch marked with K in the former Table about ,d, which noteth the artery.

δ, The *Crurall* artery which muſt bee ioyned with *d* of the former table.

ε, Two values with a propagation out of the veine.

ζ The hamme.

Θ, one great value with a propagation.

ι, The Calfe.

κ, Two values without any branch.

λ, One value with one propagation on either ſide.

μ, Two values without propagations.

ν, The *Crurall* veines, and the ſubdiuiſion of his deeper branch into 2, which alſo haue their values though wee cannot nowe follow them.

into a veine and lightly blow, then will the value ſwell out like a little bladder, or rather if we may compare little things with great, like the ſayle of a ſhippe when it runneth freſhly before the winde.

Their ſubſtance. Their ſubſtance is exceeding thinne that they might take vp the leſſe roome, yet very thight and faſt for more ſtrength that they might not be broken by the violent incurſion of the bloud.

Their vſe. Their vſe is to ſtay the bloud from falling too haſtily into the lower parts, otherwiſe becauſe the ioyntes doe hang downewarde the bloud would haue falne into them like a ſtreame, and ſo the lower parts ſhould haue beene oppeſſed by too great an affluence of Aliment, and burdened with a weight of humour, but the vpper parts ſhould haue been defrauded. Nowe by reaſon of theſe values the Aliment doeth ſubſiſt or make ſtay in the greater veſſelles as it were in a fountaine, that the ſmaller veines might alwayes haue nouriſhment at hand to conuay vnto their particular parts.

Againe, becauſe the veines were created not onely to deriue or tranſport the bloud into the parts, but alſo to adde ſomething vnto the perfection of his concoction, there is no doubt but theſe values were ordayned to ſtay the courſe and violence of the bloud that the veines might haue time to beſtow their trauell vpon it.

Thirdly they adde ſtrength vnto the veines, for were it not for theſe, it is likely that where a *varix* hapneth, there either the veine would breake, or at leaſt the dilatation be much more offenſiue. For becauſe the veine is of a membranous, ſimple and thinne ſubſtance it may eaſily be ſtreatched or broken.

Fourthly, when we exerciſe our ioynts vehemently and often, the heat of the parts is ſtirred vp and the bloud partly diſturbed partly called into the ioints, where the values do breake the force of it and ſo keepe it from miſchiefe.

Finally, if it were not for them in thoſe violent motions of the ioynts, the whole maſſe almoſt of bloud would be called into the armes and the Legs, and ſo the principall parts or bowelles of the body bee defrauded of their allowance; and thus much of the Values. Onely, becauſe they are not ſo well knowne nor ſo ordinarily demonſtrated as the other particles of the body, we haue exhibited in this Chap. 4. tables. Two of the Hand and 2. of the Foote, wherein the values of the veines are very liuely deſcribed; and ſo we proceed vnto the ſecond part of this Booke which is concerning the Arteries.

The ſecond part of the Eleauenth Booke
concerning Arteries.

CHAP. XII. *Of the Arteries in generall.*

The names of an artery. AS the Liuer is the beginning of *Radication* and *Diſpenſation* to the Veines, ſo is the Heart to the Arteries. This Artery the Grecians call ἀορτὴν, becauſe it is as an Arke or Conceptacle of arterial bloud. *Ariſtotle* in his third Booke *de hiſtoria animalium* thinketh it was called *aorta*, becauſe his neruous part may bee perceiued euen in a dead body; others thinke it was called an Artery, παρὰ τὸ τὸν ἀέρα τηρεῖν, that is, to draw ayre. Others περὶ τὸ ἀίρε θαι, which ſignifieth to lift vp, for in their dilatation they do lift vp themſelues, *Hippocrates* cals Arteries φλέβας, but *micantes*, that is, beating veines. In like manner did the Arabians ſtile them, and *Auicen* calleth them *venas audaces*, bold veines. *Pliny* calles them *ſpiritus ſemita*, the path or walke of the ſpirites. Wherefore if in any of the Ancients which wrote before *Galen* you meet with the word Artery ſimply, then muſt you vnderſtand it of the Rough Artery: for ſo *Hippocrates*, *Plato* and *Ariſtotle* did call that pipe which deſcendeth out of the mouth into the Longues, and leadeth inſpirated ayre into them and by which wee returne our breath out. But *Galen* and thoſe after him called it *aſpera arteria*, and if they ſpeake of an Artery ſimply, we muſt vnderſtand it of the ſmooth Arteries.

3. ſorts of arteries. There are three ſorts of Arteries: the firſt is called the *Rough Arterie*, of which wee ſpake in the ſixt Booke. The other is called the *Venall arterie*, of which alſo wee ſpake in the

the history of the heart. The third is called the great artery which is the subiect of our discourse at this time.

Wee consider it therefore as it is Similar and as it is Organicall. As it is similar it may bee defined *A Colde and dry part engendred of the slimy part of the Seede*. Colde it is of his owne Nature, for by euent it is most hot in respect of the bloode and spirits therein contayned. It is drie, lesse drie then a Tendon, and more dry then a Nerue. An arterie as it is similar.

But against this it may bee Obiected, that *Galen* in his second Booke *ad Glauconem* sayth, *That Neruous parts require more drying then Arteriall and therfore are dryer then they*. Obiection.

I answer, that by neruous parts in that place he doth not vnderstand nerues properlie so called, but neruous bodies as Ligaments and Tendons. Solution.

If wee consider an Artery as it is an organicall part, it may be sayde to be a common instrument of the bodie, long, rounde and fistulated compounded of two peculiar Coates, intertexed or wouen with Fibres, receyuing and contayning Bloode and Vitall Spirits laboured of a permixtion of Blood and Aire in the left ventricle of the hart, which also it conueyeth vnto all the parts of the bodie, together with heat to sustayne their life. As Organical

The substance thereof is membranous or neruous that it might better be distended or compressed which conformation was more necessary for Arteries then for veins because of their motion. The substance

The coats are one outward which is thin, rare and soft like the coate of a veyne, wouen with many right fibres and some oblique, but none transuerse. Another inward fiuefolde thicker then the former, fast and hard, partly that the arterial and spirituous blood which is thin, pure and vaporous, and the vitall spirit might not exhale or vanish away, partlie that by reason of his continuall *Diastole* and *Systole* which it receiueth from the Heart as from a beginning of dispensation it might not be broken. It is also full of transuerse fibres the better to distribute the blood and vitall spirit to the whole body in his action & motion, for the inner coate onely of the arteries hath these transuerse fibres. To these two coats *Galen* addeth a third in the fift chapter of his seauenth booke, *De administrationibus Anatom.* which some say is produced from the coate of the heart. It is in the inner surface of the vessell much like a Cobweb and most conspicuous about the productions of the greatest arteries. Coats.

Moreouer, they receyue a common and fine membrane in the lower belly from the Rim, in the Chest from the *Pleura* which couereth them, firmeth them, or tyeth them to the neighbour-parts, yet those arteries which run through the bowels haue not this coat.

The great artery is sometime called simply *great*, sometime the *greatest*, sometimes the *thicke* artery, sometime *Aorta* and is indeed the mother of all the rest of the Arteries, (except the Rough artery and the venall and vmbilicall arteries) being like a trunk or body of a tree, out of which all the branches do yssue. It was engendred, saith *Bauhine* out of *Galen de formatione fœtus*, before the Heart was formed and hath one principle of Originall, that is, the seede out of which it is immediately made as beeing engendred at the same time with other spermaticall parts; Another of Dispensation and Radication which is the heart or the left ventricle thereof, out of which it yssueth with a patent or open Orifice, whereby it receyueth from the heart in his contraction Blood and vitall spirites together with heate to be transported to the body. But because in the dilatation of the hart this blood and these spirits should not returne againe into the ventricle, there are placed in his orifice three values yssuing from within outwarde, as also there are in the arteriall veine. But these of the artery are stronger and greater, because the body of the arterie is harder then that of the arteriall veine. The great artery. His originals Values.

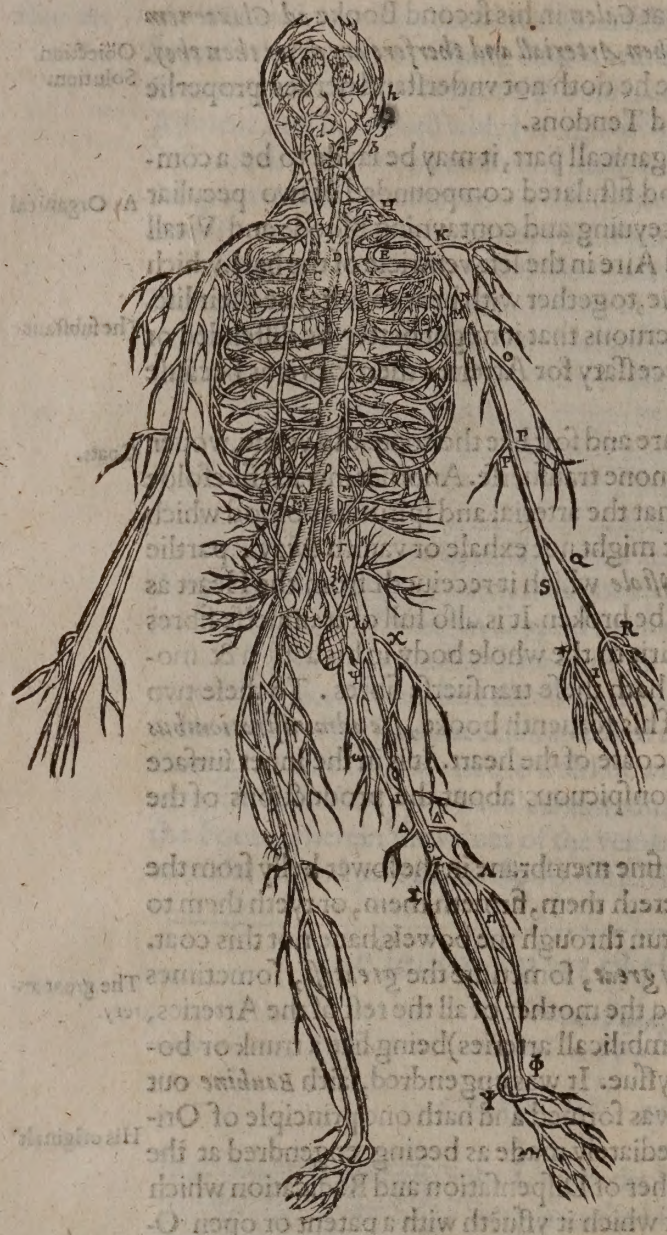
These values also doo hinder the aliment which is drawne by the Meseraicke arteries from the guts, that is the Chylus, which *Hippocrates* in his Booke *De Corde* cals *Alimentum non principale* as if he shold say an aliment at the second hand, lest I say, this Chylus shold get into the Heart. The Orifice also of this artery is established with a hard substance which is sometimes gristly, in some greater creatures a bony gristle, for it is very rare if it be found a true bone, notwithstanding that *Galen* saith it is a bone in an Elephant, but in man there is no such thing found. *Hippocrates.*

The branches of this great Arterie are distributed into the whole body, as may appeare by this Table which we haue heereto annexed.

In this distribution of the branches of the great Artery they accompany the branches of the Gate and the Hollow-veynes, yet are their propagations not so frequent, be-

Tab. xv. ſheweth the great Artery whole, and ſeparated from all the parts of the body together with his diuiſions and ſubdiuiſions.

TABVLA XV.



A. The orifice of the great Artery, or the beginning thereof, where it yſſueth out of the heart

B. *Coronaria*, ſo called becauſe like a crowne it compaſſeth the baſis of the heart.

C. The diuiſion of the great Artery into 2 trunks *Vi*.

D. The left ſubclauian climbing obliquelie vpward vnto the ribs.

E. the vpper intercoſtal artery, or a branch which beſtoweth foure propagations vnto the diſtances of the lower ribs.

F, the necke artery which through the tranſuerſe proceſſes of the racbones of the neck, attaineth to the ſcul beſtowing ſurcles vnto the marrow and his neighbour muſcles.

G, the left Mammary artery running vnder the breſt-bone, and to the nauell. It diſtributeth ſurcles to the *Mediaſtinum*, the muſcles of the breſt, and of the *Abdomen*.

H, *Muſcula*, or a branch attaining to the backward muſcles of the necke.

I, The *Scapular* arteries which goe vnto the hollowneſſe of the blade and the muſcles that lie thereon.

K, *Humeraria* which climbeth ouer the toppe of the ſhoulder.

L, *Thoracica ſuperior* ſprinkled vnto the forward-muſcles of the Cheſt.

M, *Thoracica inferiour*, which paſsing along the ſides of the Cheſt, attaineth to the *broad* muſcle of the arme.

N, the Axillary artery running out into the arme and affoording braunches vnto the muſcles thereof.

O, A branch reaching to the outſide of the cubit and lying deepe.

PP, Branches to the ioynt of the cubite with the arme.

Q. The vpper branch of the artery running along the *Radius* and offering ſurcles to the thumbe, the fore-finger and the middle finger.

k, A ſurcle creeping vnto the outſide of the hand and led betwixt the firſt bone of the thumb & that of the After-wriſt ſupporteth the forefinger where we vſe to feele the pulſe.

S, The lower branch of the Artery running along the *Vlna* and communicating ſurcles to the little finger, the ring finger and the middle finger. * A little branch vnto the muſcles about the little finger. T, the diſtribution of the vpper and lower branches into the hand and the fingers. V, the trunk of the great artery aſcending to the *Ingulum*, and the diuiſion thereof in that place into *X*, Y, *Z*. *X*, the lefte *Carotis* or ſleepy Arterie. Y *Subclauia dextra* is diuided into branches as the right is diuided. Z, *Carotis dextra* called alſo *Apoplectica* and *Lethargica*. *a*, The diuiſion of the left *Carotis* in the chops. *b*. the exterior branch of that diuiſion going into the face, the temples and behinde the eares. *c*, the inner braunch going to the throttle, the chops and the tongue. *d*, the diuiſion hereof at the baſis of the ſcull into two braunches which enter into the *ſinus* of the *Dura mater*. *e*, A propagation of the branch *b* vnto the muſcles of the face. *f*, the diſtribhtion of the branch *b* vnder the roote of the eare. *g*, the fore-branch hereof creeping vp the Temples. *h*, the backbranch running on the backſide of the eare vnder the skin. *i*, the trunke of the great Artery deſcending vnto the ſpondels of the backe. *kkk*. The lower *Intercoſtall* arteries which go vnto the diſtances of the eight lower ribs, from which are offered ſurcles to the marrow, and to the muſcles that growe to the backe and to the Cheſt. *l*, the artery of the midriffe called *Phrenica* or *Diaphragmatica*. ζ, *Meſenterica Superior*, but you muſt note that aboue ζ, the trunk of the *Celiacal* artery is taken away, leaſt the multitude of Letters in ſo ſmal a table ſhould breede obſcurity. *n*, θ, The right and left emulgents running from the *Aorta* or great Artery vnto the kidneyes. *u*, *xx*, The ſpermaticall arteries on either ſide going to the teſticles. ʌ, the lower Meſenterical artery on the left hand below μ running eſpecially into the Collicke gut on that ſide. μ, μ. The arteries called *Lumbares* which run ouerthwart and like knees affoording ſurcles to the muſcles that grow to the Loynes and to the *Peritoneum*. μ the lower; *Muſcula Superior* running into the ſides of the *Abdomen* and the muſcles.

ττ The bifurcation of the great artery into two *Iliacke* trunks, and at the sides but somewhat inward are branches which make those that are called *Sacræ*. T the diuision of the left *Iliacke* trunke into an inner branch at ξ and an vtter at φ. ξ The inner *Iliacke* branch. ο *Musculæ inferior*, the vtter propagation of the inner branch going vnto the muscles which couer the hanch bone and the *Coxendix*. π *Hipogastrica*, the inner propagation of the inner branch going to the bladder, the yarde and the necke of the wombe. ρρ The vmbilicall artery. ς The remainder of the branch ξ assuming an addition from the vtter branch neare φ and so falling through the hole of the share bone into the Leg. τ *Epigastrica*, it ascendeth vpward vnto the right muscle of the *abdomen*, and about the nauell is ioyned with the mammary artery. υ *Pudendæ*, it creepeth ouerthwart the share bone. φ The *Crurall* trunke without the *Peritonæum*. χ *Musculæ cruralis exterior* going into the fore muscles of the thigh. ψ *Musculæ cruralis interior* going vnto the muscles of the inside of the thigh. ω the coniunction of this artery with the branches. Γ *Poplitæa*, going to the muscles on the backside of the Thigh. ΔΔ which communicateth small branches to the ioynt of the knee and the muscles that make the calfe of the Leg. Θ the diuision of the *Crurall* artery vnder the hamme into three braunches. Λ *Tibiæa exterior*, it accompanieth the *Brace* bone and is consumed into the muscles. Ξ the chiefe part of the crurall artery. Σ the vpper and backer *Tibiæa*. ΠΦ The lower and backer *Tibiæa* running vnto the vpper side of the foote at Φ. Ψ A propagation of the crurall artery going to the inner and vpper side of the foot and sprinkling a branch vnto the ankle. Ω A propagation vnto the lower part of the foote which affoordeth surcles to each Toe.

cause the Artery doeth not alwayes accompany the veine, for those veines that goe vnto the skin haue no arteries with them, at least that are conspicuous. Againe they are very rarely disseminated into the muscles, but creepe onely on their outsides, because the thin bloud of the arteries and their subtle spirites when they yssue from them, are able to insinuate themselues farre into the substance of the part without the helpe of a vessell. The arteries why fewer then the veines.

CHAP. XIII. *Of the vse of Arteries.*

THE vse of the great Artery and of his branches may bee considered two wayes; eyther as they are Canales or Pipes, or as they mooue and beate perpetually. As they are Canales or Pipes they haue three vses or ends. First to contayne spirituous and vitall bloud, and to distribute it vnto the whole body, partly for the perfect nourishment of the particular parts, for the parts, sayth *Galen* in the tenth chapter of his sixt Booke *de vsu partium*, which are neare vnto the Arteries doe draw out of the vaporous bloud though it be but little; partly for the nourishment and generation of the animall spirits. A double consideration of their vse. 3. vses as Canales,

The second vse is to leade vnto the parts vital spirits, to cherish and sustaine those vitall spirits which are seated in the parts. Thirdly, with the same spirit to transmit heate and the vitall faculty perpetually into the whole body, to cherish the in-bred heat of the particular parts, to moderate and gouerne their vitall functions and to defend their life.

As the Arteries doe beate, so haue they also a treble vse. The first is to preserue the in-bred heat of all the members which they do by ventilation or wafting ayre vnto them. For if it were not breathed it would by degrees languish and be extinguished. Their second vse is by their motion to make a kinde of commotion in the bloud (for the arteries accompany the veines) which if it were at rest would putrifie like standing waters, for bloud sayeth *Hippocrates* is water. The third vse is to solliciate and to compell the bloud to fall out of the veines into the substance of the parts for more speedy nourishment. 3. vses in respect of their motion.

This motion of the Arteries is called *pulsus* or pulsation (of the worde *Hippocrates* as *Galen* witnesseth was the first authour) which is absolued by dilatation and contraction: qualities not bred with the artery or seated in their substance, but flowing into them from the heart, which may be demonstrated if you intercept a part of an arterie with a tie, for the part that is vnder the tye will haue no motion, but as soone as the tye is taken away the motion will returne. Pulsation.

Erasistratus conceiued that the Arteries mooued quite contrary vnto the motion of the heart: but wee agree rather with *Herophilus*, *Aristotle* and *Galen*, who thinke they are dilated and constringed in the *Diastole* and *Systole* of the heart: onely we must remember, that the motion of the heart is swifter and more vehement then that of the arteries, which you may thus make experience off. Lay your right hand vpon your heart, and with your left hand touch the wrest of the right hand, and then you shall perceiue whether the motion of both bee the same or contrary, but the more certaine knowledge of this poynt is taken from the dissection of liuing creatures.

In the contraction of the Arteries they strongly driue vital spirits into the whole bo-

dy

dy and expel by expreſsion ſooty and ſmokie excrements ariſing from the humors which otherwiſe would ſuffocate the head. When they are dilated they ſnatch from the heart ſpirits as a new matter which in their contraction they communicate to the particular parts to be a vehikle of the heat, and do aſſume out of the neighbour veynes natural blood for their proper nouriſhment by the inoculations which are betwixt them and the veines; and that is the reaſon eſpecially why the veines & the arteries do walke together throughout the whole body vnleſſe ſome great obſtacle be in the way. But the arteries lye vnder the veynes vnleſſe it be at the holy-bone, not ſo much for defence as becauſe by their motion they might conſtraine the veynes to powre out their blood, as alſo to make a conſpiration or conſent betwixt the veſſels, and a communion of their matters that the arteries might affoord vnto the veynes ſpirit and life, and the veynes vnto the Arteries naturall blood.

Why they lye vnder the veines.

Againe, by this vicinity of the veſſels the membranes which couer the veynes & tye them vnto the parts by which they paſſe, are alſo of great vſe vnto the Arteries.

It is alſo thought that theſe Arteries by the pores of the skin do draw Aier whereby the heate which is within is breathed, which breathing is called Tranſperation. But concerning the motions of the Arteries and by what faculty they are mooued, whether they moue as the heart mooueth, or contrary vnto it, wee haue intreated in the ſecond, third, fourth, and fift Queſtions of the Controuerſies of the ſixt booke, to which place we referre the Reader.

CHAP. *XIIII. Of the aſcending Trunke of the great Artery.*

The great Artery.

THE great artery at the left ventricle of the heart from whence it ariſeth is exceeding large, whence *Hippocrates*, *Plato*, *Ariſtotle*, and *Galen* haue al agreed that the heart is the fountaine and originall of Arteries, [Tab.16, fig.1^A] and before it fall out of the *Pericardium* or purſe of the heart aboue the values, [Tab.16, fig.3, char.1,2,3,] it affoordeth ſometimes one ſometimes two coronary arteries, [Tab.16, fig.1, ^BB] which like a Crowne do compaſſe the Baſis of the heart, and through the length thereof together with the veyne diſmiſſeth branches which are more and larger in the left ſide, and thoſe make the ſubſtance of the heart viuide or liuely. Preſently after, a little vnder the trunke of the Arteriall veyne, it ariſeth vpward & piercеth through the *Pericardium*, & is diuided into two vnequal parts, one of which aſcendeth vpward [Tab,16, fig.1, ^B] vnto the head which is the leſſer, the other and the greater by much runneth downward [Tab.16, fig.1, ^D] becauſe the parts of the creature which are vnder the hart are more a great many & greater thē thoſe that are vnder it. This trunk is proportionably anſwerable to the ſtocke or body of the tree, and inclineth vnto the fift rackebone of the cheſt, and declining a little to the left hand to giue away vnto the hollow veine, it deſcendeth vpon the rack-bones vndiuided, which part *Ariſtotle* properly called *Aorta*, becauſe euen in dead bodies the neruous part thereof was conſpicuous, haply becauſe it is like to a Macedonian ſheath which is called ἀορτή. *Praxagoras* vſed to call it *Craſſa* or the thicke Artery. From this trunke, branches are diſperſed which accompany the branches of the gate and hollow veynes into the whole body.

The coronary Arteries.

The greater Trunke.

From the greater trunke therefore [Tab.16, fig.1, ^D] which in the cheſt is largeſt and thickeſt, do iſſue theſe branches following.

Intercoſtales Inferiores.

The lower intercoſtall Arteries [Tab.16, fig.1. HHH] which proceeding in order from his hinder ſide, are ſent on eyther hand to the diſtances of the eight lower ribs, as far as to their griſtles: and theſe againe do diſtribute ſurcles to the muſcles which grow vnto the backe and cheſt, and to the ſpinall marrow through the holes which are made in the rack-bones for the out-lets of the nerues, after the ſame manner that the veyne *Azygos* diſtributeth his branches: for it is very rare to find the veyne *Azygos* accompanied with an artery iſſuing from the *Aorta*, and then it may well bee called *Intercoſtalis maior*, or the great intercoſtall artery.

Phrenica.

Secondly iſſueth the artery called *Phrenica* on eyther ſide one, [Tab.16, fig.1, ^KK] which is diſſeminated through the midriffe, and from theſe are ſmall branches ſprinkled alſo to the *Pericardium* where it groweth to the midriffe. Sometime this *Phrenica* ariſeth from the trunke vnder the midriffe. The reſt of the trunke that remaineth paſſeth through the fiſſure of the midriffe [Tab.15, fig.1, *] cleauing to the bodies of the rack-bones and from it are many propagations diſtributed throughout the lower belly, of which we ſhal ſpeak in the next chap. and in in the 16.

From

From the leſſer and aſcending trunke [tab.16.fig.1 [r]] which amongſt the ſeparating membranes lieth vnder the hollow veine and reſteth vpon the rough artery are branches communicated to all the parts aboue the heart.

Firſt of all it ſendeth on either ſide a notable branch which vnder the coller bone attaineth vnto the firſt rib of his owne ſide, and therefore it is called the *Subclauian* artery. Afterward the whole trunke departeth into the two ſleepy arteries.

The right *ſubclauian* artery [tab.16.fig.1 [s] whoſe original is at [a]] iſſueth out of the *Aorta* where it is diuided into the ſleepy arteries: and this is the higher and larger branch, and runneth more ouerthwart then the left which ariſeth much lower where the *Aorta* is retorted downward and attaineth more obliquely vnto the arme. The right ſubclauian artery.

From either *ſubclauian* before it fal out of the cauity of the Cheſt (for when it is out of the Cheſt it is no more called *ſubclauia* but *Axillaris*) [tab.16.fig.1 [pp]] as ſoone as it toucheth the firſt rib and not before, are propagations deriued from the lower part; firſt.

Table 16. Is the ſame with Table 13. in follio 382.

The vpper intercoſtall [Tab.16.fig.1,11] which being faſtned to the roots of the ribs communicateth particular branches to three or foure diſtances of the vpper ribs on his owne ſide; (But not alwayes after the ſame manner) from which ſurcles are diſtributed to the marrowe of the backe and to the Neighbour-muſcles. From the vpper part doe yſſue. *Intercoſtalis ſuperior.*

Firſt the *Mammaria* or the Artery of the paps [Tab.16 fig.1 [ll]] which being reflected vnder the breſt-bone deſcendeth accompanied with a Veine vnto the pappes and the muſcles [Tab.16.fig.1 [ccc]] which occupy the diſtances of the griſtles of the true ribbes. It ſprinkleth alſo ſurcles into the Glandules and the parting or diuiding membranes vnto which it adhereth, and at the ſide of the griſtle called the breſt-blade yſſueth out of the Cheſt and runneth vnder the right muſcles of the *Abdomen* diſperſing his fauors into the ſides. At the Nauell it is diuided into many ſurcles, [Tab.16.fig. 1 [dd]] and is ioyned with the Epigaſtricke Artery which plyeth vpward. [Tab.16. fig.1. [ee]] *Mammaria.*

The next artery which ariſeth from the vpper part of the Subclauian trunke is called *Ceruicalis* or the artery of the necke. [Tab.16.fig.1 [mm]] It iſſueth more backward towarde the bodies of the racke bones, ſometimes from the ſleepy artery, and aſcending vpwarde when it hath attained vnto the ſeuenth rackbone of the neck, it paſſeth through the holes in the tranſuerſe proceſſes of the ſaide rackbones, for which cauſe alſo Nature made thē perforated; and diſtributeth his ſurcles to the muſcles, the marrow of the necke, and to the Rack-bones. Theſe ſurcles go in where the nerues get out. There this artery perforating the membrane of the marrow betwixt the firſt racke and the Nowle-bone [tab.16.f. 1 [nn]] entreth on both ſides into the ſcull, ioyneth with his oppoſite & runneth along the baſis of the Braine. *Ceruicalis.*

The third is called *Muſcula* [tab.16. fig.1. OO] It ſendeth branches vnto the Muſcles which lye vpon the necke as farre as the nowle: ſometimes alſo to the Muſcles of the Arme. *Muſcula.*

After this trunke hath gotten out of the cauity of the Cheſt, wee ſaide before that it getteth a new name and is called *Axillaris*. From the axillary Artery therefore [tab.16.fig 1 [pp]] before it attaine vnto the arme there yſſue three Arteries.

The firſt is called *Thoracica ſuperior* [tab.16.figu. 1, [qq]] which runneth on eyther ſide with aboundant ſurcles vnto the Muſcles which lye vpon the breſt, and next vnto theſe are thoſe ſmall ſhootes which are allowed to the little glandules vnder the Arme-pits. *Axilaris arteria Thoracica ſuperior.*

The ſecond is called *Thoracica inferior* [tab.16.f.1 [rr]] which runneth downward all along the ſide of the cheſt, eſpecially into that muſcle which is called *Latiſſimus* or the Broade Muſcle. *Thoracica inferior.*

The third is called *Scapularis* [Tab.16.fig. 1 S] which is diſſeminated into the Muſcles repoſed in the hollowe ſide of the ſnoulder-blade. From the vpper part of the Axillarie branch ariſeth one artery called *Humeraria* [tab.16.fig.1 [tt]] which climbeth to the top of the ſhoulder, and is diſtributed to the Muſcles which occupy the arme and the gibbous ſide of the blade. That which remaineth of the axillary artery [tab.16.figu.1 [vv]] runneth away vnto the arme being accompanied with the axillary veine whoſe diuiſions we ſhall finde in the 19 chapter. *Scapularis.* *Humeraria.*

The remainder of the aſcending trunke [tab.16.fig.1 [r]] reſting it ſelfe vpon the rough artery toward the vpper part of the breſt-bone being yet in the cauity of the cheſt is ſupported

Carotides

ported with the *Thymus*, and diuided into two vnequall branches which they call *Carotides* [tab.16.fig.1 [x y]] or *soporales* the sleepy Arteries. These tend directly vpward, so that the right as also the left run through the sides of the neck vnto the basis of the scull being tied to the rough Artery and the internall Iugular veines with a membrane, (for the Externall Iugulars are without arteries) and so reach vnto the heade where wee shall finde them in the 17 chapter.

CHAP. XV. *Of the descending trunke of the great Artery accompanying the Hollow Veine.*

7 braunches before the diuision.

THE Trunke of the great Artery [Tab. 17 [L]] at the eleuenth racke-bone of the Chest passing through the Midriffe [Tab.17.char.4] runneth through the lower belly leaning vpon the left side of the bodies of the racks, and lying vnder the left side [tab.17,L] of the hollow veine [Tab.17,[x]] declining somewhat to giue roome thereunto, and before it come to the last Racke saue one of the Loines, in some bodies at the Holy-bone [tab. 17, char.14] where it is diuided into two trunkes, it affoordeth seuen branches, whereof some do accompany the branches of the Gate-veine, as that called *Cœliaca* and the double Mesentericall branch which depart vnto the Stomacke, the Mesentery and the Guts, of which we shall speake particularly in the next chapter.

Others accompany the branches of the Hollow-veine couered with the *Peritonæum* or Rim of the belly, of which we shall intreat in this chapter. For Nature almost alwaies diuideth the Arteries where she diuideth the Veynes, partly that the membranes wherewith she coureth the Veines and fastneth them to the neighbour parts might bee of vse likewise vnto the Arteries, partly also that there might be a conspiration between the vessels and a communion of matters, for there are few Veines without arteries ioyned vnto them vnlesse it be those that run immediately vnder the skin. Now the order of the branches as they arise out of the trunke is on this manner.

Cœliaca. Mesenterica superior. Emulgens

The first is called *Cœliaca* [Tab.17, char.6]

The second *Mesenterica superior*. [Tab.17,char.10]

The third *Emulgens* or *Renalis* the artery of the Kidneyes [Tab.17, [d e]] one left and another Right, sometimes but rarely we finde three or foure or more. This is a notable branch and well nie the greatest of all that arise from out of the great artery. It issueth out of either side of the trunke where the first and second rack-bone of the Loins are coupled with a Ligament, and pacing obliquely at the cauity of the Kidneyes it is diuided as the Veines are, and so implanted thereinto and therein consumed, imitating for the most part the distribution of the Veines.

Their Vse.

Their vse is not so much to leade vitall blood as to purge away the whey from the vital blood of which there is aboundance in the great artery. Notwithstanding the fat Membrane of the Kidnies though they be neere at hand, doe not scarse at all partake of these arteries.

Spermatica.

The fourth is called *Spermatica*, the seede artery. [Tab.17,char.11] Both of them issue together (for their originals do touch) out of the forepart of the trunke, and descending the right rideth ouer the trunke of the hollow veine, is fastned vnto the spermaticall veine of his owne side (as the left is to the left) by the mediation of the *Peritonæum*. Afterwarde in men they passe the productions of the same *peritoneum* and are applyed with a winding passage to the Testicles, whereto as also to their coats they affoord surcles. The vse of which application is to leade vnto them venall and arteriall bloode and vitall spirits. But in women the one halfe goeth to the Testicles, the other vnto the bodye of the wombe. And from these *Columbus* thought the vmbilicall arteries had their original, but what reason he had for his conceite there I leaue him.

Mesenterica inferiour. Lumbaris

The fift is called *Mesenterica inferior*. [Tab.17, Char. 12]

Table xvij. Is the same with the eight of the third Booke in folio 115.

The sixt is called *Lumbaris* [Tab.17 the vpper [mmmm]] These are two arising out of the backside of the Trunke where it ioyneth to the rackbones and run crookedly through the holes of the rackes of the Loynes and are distributed vnto the spinall marrow, as also the Neighbor-muscles & to the *Peritonæum*. These also at the sides of the marrow together with the veines run vpward to the braine. *Columbus* maketh mention of no more braunches before the diuision of the great artery, but *Laurentius* whom *Bauhine* also followeth addeth a seuenth.

The

The ſeauenth therefore is called *Muſcula ſuperior* [Ta.17.the lower mm] which alſo is referred to the *Lumbares* but larger then the reſt and runneth out vnto the ſides of the *Abdomen*, and bleſſeth his muſcles with aboundant ſurcles. *muſcula ſuperior*

After theſe branches are diſtributed, the great artery at the beginning of the Holy-bone [Ta.17.char.14.] climeth ouer the hollow veine, not as challenging the ſuperiority, but becauſe being perpetually mooued it might haue beene offended if it had beaten againſt the bare bone.

At this place by reaſon of the parts through which it paſſeth it is called *Iliaca*, [Tab. 17.r] and as the hollow veine ſo is it deuided aboue the body of the fourth Racke of the Loynes into two trunkes after the manner of Χ inuerted or turned vpſide downe. Vnder this bifurcation yſſueth the artery called *Sacra* [Tab.17.oo] whoſe ſurcles runne through the holes of the holy bone vnto his marrow. Not far from the deuiſion each trunke [Tab 17.p] is deuided into an interior or ſlender branch [Tab.17.p] and an exterior or greater [Ta.17.5] which falleth vnto the Leg. From the interior branch yſſue two propagations, one vtter the other inner. The bifurcation of the trunke.

The vtter is called *Muſcula inferior* [Ta.17.ff] and runneth tranſuerſly [Ta.17.f] outward betwixt the holy-bone and the bone of the hip, and is diſtributed with many ſurcles into the muſcles which couer the haunch-bones and the hippe-ioynt. In like manner at the groyne from one of the trunkes ariſeth a notable branch which runneth vnto the skin and cheriſheth the *Cutany* parts which appertayne vnto the ſhare, to the hanches and to the *abdomen*. *Muſcula infer.*

The inner is called *Hypogaſtrica* [Ta.17.uu] which is the largeſt of all the reſt, and runneth directly downward to the lower part of the *Os ſacrum*, to the bladder and his necke, (ſome ſay alſo to the fundament, and may there be called the *Hemeroidall* arteries) and finally to the muſcles which couer the ſhare-bone, into all which parts his ſurcles are diſtributed. *Hypogaſtrica.*

In women this *Hypogaſtrica* is yet larger, and is diſtributed aboundantly into the bottom of the wombe. It ſprinkleth alſo the necke thereof and the bladder with ſmall ſurcles. It ſendeth foorth alſo a branch which vnder the bifurcated originall of the yarde runneth ſtrangely intangled to his two hollow bodies, ſo making a kinde of web or complication and then paſſeth vnto the nut The remaynder of the *interior* branch [ta.17.s] creepeth downward, and admitteth vnto it the vmbilicall artery [ta.17.at x] which paſſeth throughout the length of the great artery, & at the ſides of the bladder for more ſtrength is tyed with ſtrong membranes, by which vmbilicall artery the Infant in the womb liueth and enioyeth Tranſpiration, but after the Infant is born it turneth into a tye or ligament of which we haue ſpoken ſufficiently before. *Arteria vmbilicalis.*

Preſently after when it hath aſſumed a propagation which is ſent obliquely downward from the external branch [ta.17.r] where it is about to fall into the Leg; [ta.17.t] it paſſeth through the hole of the ſhare-bone, and is diſperſed into the muſcles which occupy that hole, and into thoſe that neighbour about it.

The *Exterior* branch of the byfurcation ſendeth out two branches, one before it hath paſſed the *Peritoneum*, another after.

The firſt is called *Epigaſtrica*, [Tab.17.char.22.] and reflected vpward, climeth ouer the right muſcle, and his eſpeciall branches about the Region of the Nauell are ioyned with the mammary; the reſt of his ſurcles hee diſperſeth tranſuerſly into the lower ſide of the *abdomen*. *Epigaſtrica.*

The ſecond is called *Pudenda* [Ta.17.char.15.] a little branch not deuided into ſo many ſurcles as is the veine. It runneth tranſuerſly and inward a long the commiſſure or ioyniug together of the ſhare-bones vnto the Priuities, and is conſumed in the skinne of the yard. Sometime alſo ſmall arteries are ſent vnto the glandules of the groyne: againe often from one ſide a reaſonable braunch is produced vnto the groyne, which cheriſheth not onely the skinne about the ſhare, but alſo thoſe partes which pertaine or reach vnto the haunches or to the *abdomen*. The remaynder of the artery [Ta.17.char.18.runneth into the Leg and maketh the *Crurall* arteries, of which we ſhall ſpeake in the 20. Chapter: and thus much of the braunches of the great Artery which accompany the hollow veine in the lower belly. Now we come vnto thoſe that accompany the Gate veine. *Pudenda.* *Cruralis.*

CHAP.

CHAP. XVI. *Of the Arteries accompaning the branches of the Gate-veyne through the lower Belly.*

THE arteries which accompany the branches of the Gate-veyne are three. The first is called *Cœliaca* [Tab. 18, fig. 1, [m] Tab. 17, char. 6,] the second *Mesenterica superior*, [Tab. 17, char. 10,] The third *mesenterica inferior*, [Tab. 17, char. 12.] The *Cœliaca* [Tab. 18, fig. 1, [m] Tab. 17, char. 6.] is so callled because it sendeth many branches vnto the stomacke, and therefore wee may call it the stomacke artery. It is a notable vessell and because like the gate-veyne it offers his branches to the stomacke, the kell, the *Duodenum*, the beginning of the *Ieiunum*, a part of the collicke gut, to the Liuer, the bladder of gall, the *Pancræas* and the spleene, wee will fit his names vnto the names of the gate-veyne.

Cœliaca.

It ariseth from the forepart of the body of the great artery at the spine of the backe. And the vpper part thereof is sustained in his course by the lower membrane of the *Omētum* or kell. Afterward it is diuided into two branches, a right [Tab. 18, fig. 1, [n]] which is the lesser; and a left [Tab. 18, fig. 1, [n]] which is somewhat greater. Both of them spring as it were out of one roote, and vnder the back-side of the stomacke are fastened to the gate-veyne in the *Pancræas*.

The diuision thereof.

The right [Tab. 18, figure 1, [n]] ascendeth vpward into the hollow part of the Liuer, hauing some part of his way sprinkled branches, some from his vpper part some from his lower. From his vpper part two.

Gastrica dextra.

The first is called *Gastrica dextra*, the right stomacke artery. [Tab. 18, fig 1, [p]] It issueth out of the middle of the passage and distributeth his surcles into the backe-side of the right orifice of the stomacke.

Cystica gemellæ.

The second are two small twin-branches called *Cystica gemellæ*, [Tab. 17, char. 8, Tab. 18, fig. 1, [f] fig. 2, [x]] because they go vnto the bladder of gall. From the lower branch issue three branches.

Epiplois dextra.

The first is called *Epiplois dextra* the right Kell artery, [Tab. 18, fig. 1, [o] fig. 2, [h]] and is offered to the right side of the lower kell, and to the collicke gut which is fastened thereto.

Intestinalis.

The second is called *Intestinalis* the gut artery, [Tab. 18, fig. 1, [q] fig. 2, [d]] and is sent vnto the *Duodenum* and the beginning of the *Ieiunum*.

Gastro epiplois dextra.

The third is called *Gastro-Epiplois dextra*, the right stomacke and kell-artery. [Tab. 18, fig. 1, [r]] It is larger then the former, and is retorted or bent backward to the right side of the bottome of the stomack, and leaning vppon the vpper membrane of the Kell, sprinkleth very plentifull surcles into the foreside and hindside of the bottome of the stomacke, as farre as vnto the middle thereof. That which remaineth of the right branch determineth into the hollow part of the Liuer, [Tab. 17, char. 7, Tab. 18, fig. 1, [r] fig. 2, [y]] yet not deepe, to conuay vnto it vitall spirit.

Arteria splenica

The left branch [Tab. 18, fig. 1, [n]] which is also called *Arteria splenica*, the Artery of the spleene passeth with an oblique and crooked course through the *Pancræas* [Tab. 18, fig. 2, [i]] vnto the Spleene. [Tab. 18, fig. 2, [m]] It is larger then the right branch that it might not easily be obstructed, for it doth not onely suggest into the Spleene plenty of vital spirits, but also vomitteth out and purgeth into the same the thicker and more fœculent matter of the spirituous blood contained in the great Artery. It is fastened to the splenicke veyne and is distributed like vnto it, for from it before the diuision there issue from the vpper part two Arteries, and as many from the lower.

His diuision.

Gastrica maior.

The first that issueth from the vpper part is called *Gastrica maior*, the greater stomacke Artery, [Tab. 18, fig. 1, [x]] which offereth to the stomacke a propagation in the backe and vpper part; wherefrom a surcle [Tab. 18, fig. 1, [y]] runneth vnto the middest of the stomack.

Coronaria stomachica.

Another also called *Coronaria stomachica*, the Crowne artery of the stomacke, [Tab. 18, fig. 1, ch. 2, fig. 2, [g]] which reacheth to the vpper orifice compassing it about like a crowne, and it alloweth small surcles to the body of the stomacke and to the gullet.

Gastrica sinistra

The second is called *Gastrica sinistra*, the left stomacke artery. [Tab. 18, fig. 1, [α]] It is a propagation of the former *Gastrica maior* running on the right hand into the vpper parts of the stomacke, and distributing surcles on both hands which attayne vnto the *Pylorus* or lower mouth of the stomacke.

Epiplois postica.

From the lower part of the left branch issue likewise two arteries. The first is called *Epiplois postica*, [tab. 18, fig. 1, [β] fig. 2, [c]] the hinder kell-artery, which presently is diuided into

into two furcles ſeparated farre one from another, and thoſe into others which are propagated into the lower membrane of the kell and the collick-gut which is tyed thereto.

Table 18 is the ſame with Table 4. Lib. 3. folio 102.

The ſecond is called *Epiploïs ſiniſtra*, the left kell-artery. [Tab.18,fig.1,] It is alſo ſent to the lower membrane of the kell and runneth out into his left ſide. That which remaineth of this branch [Tab.18,fig.1,u] attaineth to the ſpleene, and is diuided into an vpper and a lower branch, and theſe againe are diuided into others vntill many branches doe touch the hollow part of the ſpleene, [Tab.18,fig.1,ſ] and are diſperſed through his ſubſtance. *Epiploïs ſiniſtra*

Table 19 is the ſame with Table 7. Lib. 7. folio 448.

Out of the lower part of this remainder iſſueth that artery which is called *Gaſtro-epiploïs ſiniſtra*, [Tab.18,fig.1,s] which is ſupported by the vpper membrane of the *Omentum*, writhen toward the right hand that it might creepe vp the left part of the bottom of the ſtomacke, and ſendeth crooked and bent branches to the fore ſide and back-ſide thereof, and to the vpper membrane of the kell. *Gaſtro-epiploïs ſiniſtra.*

Out of the vpper part of the remainder iſſueth that which is called *Vas breue arterioſum, The ſhort arteriall veſſell*, which is inſerted into the vpper part of the left ſide of the bottome of the ſtomacke. *Vas breue arterioſum.*

And this is the diuiſion of the *Cœliacall* Artery in the lower belly which is the firſt of the three that accompany the branches of the Gate-veine. The ſecond and third are the two Meſenterick Arteries both which yſſue from the foreſide of the trunke, the vpper below the *Cœliacal*, the lower below the Spermaticall.

The vpper Meſentericall artery [Tab.17,char.10, Tab.18,fig.1. & fig.2,p] is propagated into the vpper part of the Meſentery, yea almoſt into all of it, and ſprinkleth abundant furcles into the *Ieiunum*, the *Ilion*, and the Collick guts at the right kidney. *Meſenterica ſuperior.*

The lower meſentericall artery, [Tab.17,char.12, Tab.18,fig.2,q] runneth vnder the lower ſide of the meſentery and is eſpecially diſtributed into the left ſide of the collick and into the right gut, and deſcending together with the veynes vnto the fundament, maketh the Hemorrhoidall Arteries. [Tab.18,fig.*] *Inferior.*

The vſe of theſe meſentericall branches is not ſo much to conuay heate vnto the parts, as by their motion and vitall ſpirit to preſerue the meſentery and the guts from corruption and putrifaction. *Hemorrhoidales* The vſe of the meſenterical artery.

Some are of opinion that theſe branches do ſucke out of the guts the pureſt part of the chylus for the generation of arteriall blood and conuay it to the left ventricle of the heart: but the values which are ſet at the beginning of the great artery, and ſhutte vp the paſſage from the artery into the heart onely, & not out of it againe, do contradict ſtrongly that conceite. *Varolius* his conceite Refuted.

Hauing thus brought the great artery through the middle and lower regions of the body, we will now returne vnto it again, where we left it in the end of the 14 chapter diuided into two Soporary Arteries and climing vnto the Head.

CHAP. XVII. *Of the Arteries of the Braine.*

THE artery called *Carotis* or the ſleepy artery, and by *Archangelus Arteria Iugularis* becauſe it is accompanied on the inſide with the internall Iugular veyne, aſcendeth vnto the chops on eyther hand by the ſides of the rough artery, and there is diuided into two branches. One externall, of which we ſhal ſpeake in the chapter following. Another internall, which is alſo the larger conuayed to the Chops, which hauing affoorded certaine furcles to the tongue & the Larinx is diuided at the baſis of the braine [Tab.19,fig.13,x] into two vnequall branches. The ſleepy artery. His diuiſion.

The firſt artery of the brain according to *Bauhine*, according to *Veſalius* the 3, [ta.19,fi. 13.l-fi.15,cc] is little leſſer then the Trunk it ſelfe, & runneth vp whole & ful til it come vnto a proper hole bored for it in the temple-bone, & through it attaineth into the cauity of the Scull at the ſaddle of the wedge-bone, and being yet vnder the *Dura mater*, firſt of al it affoordeth a branch on each hand into the ſide of the ſame Meninx. [Tab. 19,fig. 15,D] Afterward in brute beaſts it parteth with an infinite number of furcles, and maketh that texture which is called *Rete mirabile*, the wonderfull Net; of which *Galen* wrote ſo curiouſly that *Veſalius* followeth him to a haire, and that figure is the 14 of this 19 Table, but the 16 fig. of the ſame table exhibiteth the forme thereof, as it appeareth in brute beaſts eſpecially in Oxen, Calues, and Sheepe. The firſt artery of the Braine. *Rete mirabile.*

In men though there be indeed ſuch a knot or texture, yet it is not ſo notable, and but a very

very ſhadow in reſpect of that in bruite beaſts, and yet notwithſtanding the Artery is not conſumed into theſe propagations but remaineth alwayes ſound. [Table. 19. fig, 16, [B c]] Preſently after it perforateth the *dura meninx* and runneth ſometimes ſingle, ſometimes double, [tab. 19. fig. 15 [F]] yet ſo that it preſently vniteth again, and when it hath tranſmitted the leſſer branch [K] through the ſecond hole of the VVedge-bone, it creepeth out of the ſcull vnto the eye and the temporall Muſcle [tab. 19. figu. 11 [R]] together with the Opticke nerue to giue it and his Muſcles life, & ſendeth the greater branch vpwarde, which preſently at the ſide of the Flegmaticke Glandule is diuided into two branches. The inner wher of is vnited with the inner arterie of the oppoſite ſide, and ſo being vnited they are conſumed into many ſmal arteries which at the original of the optick nerues are diſſeminated through the *pia Mater* and the ſubſtance of the Braine. [Tab. 19. fig. 13 [c]] The other being reflected [tab. 19. fig. 13. at the vppermoſt [A] fig. 15 [c]] and entangled in the *Pia Mater*, runneth into the forward ventricle diuided into many ſmall braunches, ſome of which are vnited with thoſe ſmall arteries which attained hither from the *Cerui calis* or artery of the necke through the baſis of the Head vnder the Braine. Some others run diſioyned through the *pia mater* or thin membrane and through the ſubſtance of the Braine it ſelfe, which with other ſurcles make that complication of veſſels which they call *Plexus Choroides*, ſo that this complication is compounded of foure arteries.

Plexus Choroides.

The ſecond Artery of the Braine [ta. 19. fig. 13 [q]] is a branch of the former which runneth obliquely, and when it hath attained into the ſcull through the ſecond hole of the Temple-bone, it is diuided into two branches; whereof one runneth outward and the other inward. The vtter which *Veſalius* calleth the ſecond ſmall branch of the third artery [tab. 19. fig. 13 ſ] endeth through the eight hole of the Wedge-bone into the cauity of the Noſethrilles [Tab. 19. figure. 15 [z]] where the Pulſe is felt; and offers a little ſurcle to the end of the Noſe [Tab. 19. fig. 12, t] but the interiour branch is diuided into two at the firſt Hand [tab. 19. fig. 13 [uu]] which *Veſalius* calleth two great branches of the third artery. Afterward it ſendeth out of his vtter part another ſmall braunch, [Tab. 19. fig. 13 [r]] which *Veſalius* calleth the firſt ſmall branch of the third Artery, this branch togither with the ſecond Veine, [r] and after the ſame manner and for the ſame vſe is diſtributed into the *dura meninx* or thicke Membrane.

The 2 Artery.

The pulſe of the Noſe.

The third Artery of the Braine which according to *Veſalius* and *Platerus* is the ſecond, [Tab. 19. fig. 13, I] is leſſe then the firſt and runneth together with the branch of the internall Iugular veine [tab. 19. fig. 13, C] vnto the backeſide of the Scull, and hauing affoorded a ſurcle vnto the Muſcles which occupy the inſide of the necke [*] it entreth in at the firſt hole of the Nowl-bone, and ſo paſſeth into the *ſinus* of the *dura Meninx*.

The 3. arterie of the Braine.

The fourth Artery (which according to *Veſalius*, *Falopius* and *Platerus* is the firſt) is a propagation of that axillary artery being yet within the Cheſt which is called *Cerui calis*. This ariſing vpward through the holes of the tranſuerſe proceſſes of the neck, after it hath giuen ſome ſurcles to the muſcles thereabout, betwixt the head and the firſt Racke of the necke it perforateth the thicke membrane which inueſteth the ſpinall marrowe in the ſide thereof: to which after it hath giuen ſome propagations it entreth into the cauity of the Scull through the great hole. Afterward vnder the marrow it is ioyned with his companion of the oppoſite ſide, which being ſo vnited do paſſe along vnder the middle of the baſis of the Braine till it come vnto the ſaddle of the Wedgebone wherein the Phlegmaticke Glandule is contained. There againe it is diuided into two braunches. The right runneth to the right ſide of the ſaddle, the left creepeth on his owne ſide as farre as to the ſecond paire of ſinewes, where on both hands it is diuided into infinite ſurcles and diſſeminated betwixt the firſt and ſecond paire of finews, and complicated or intangled with the *Pia Mater* which afterward do make the *Plexus Choroides*. And thus much of the diſtribution of the arteries within the braine.

The fourth.

Moreouer, we muſt imagine that from theſe ſleepy arteries an innumerable number of ſurcles or propagations are ſprinkled heere and there throughout the whole ſubſtance of the Braine.

The Vſe of the arteries of the Braine is to bee conſidred either as they are Canales or pipes running through the Braine, or as they are perpetually mooued.

The vſe of the arteries of the Braine.

In the firſt conſideration they were made to conuey vitall Bloode from the Heart vnto the Braine, as alſo vitall ſpirits to ſuſtaine the vitall ſpirits that are bred and feared in the ſubſtance thereof; neyther do they carrie vitall ſpirits onely, but alſo the vitall faculltie

ty furniſhed with all his indowments.

As they beat continually their vſe is perpetually to ventilate the ingenite heate of the Braine, which otherwiſe would quickly languiſh and be extinguiſhed. Againe, this pulſation moueth and worketh the bloud in the veines, which if it ſtood ſtil and at reſt would like ſtanding water ſooner putrifie and corrupt. Finally, to ſollicite the Alimentary bloud which is thicker, to yſſue out of the veines through ſmall pores and vents or breathing paſſages into the ſubſtance of the braine (which alſo doeth ſomewhat drawe it) for his nouriſhment and refection.

Now we proceede vnto the exterior branch of the Sleepy Artery.

CHAP. XVIII. *Of the Arteries of the Face, the Eyes, the Noſe, the Teeth, and the Larynx.*

THE *Carotides* or ſleepy Arteries [Tab. 16.[xy]] being on both ſides one, doe accompany the Iugular veines by the ſides of the neck, and cleauing to the Rough artery aſcend vnto the head, and when they come vnto the Chops they are deuided [Tab. 16.[ff]] into an vtter branch [g] and an inner, [h] the diſtribution of the inner we had in the former Chapter. The diuiſion of the ſleepy artery.

The vtter which is ſmaller then the inner and conſiſteth without the Choppes, lendeth ſurcles to the Cheeks [l] and to the muſcles of the Face, afterward when it commeth vnto the roote of the Eare [m] it is deuided into twaine, one of which runneth to the backſide of the Eare, [o] from which two arteries vnder the Eare doe paſſe into the neather Iaw, & throughout the length thereof are diſperſed vnto the roots of all the lower teeth, another part of it breaking out through a hole at the Chinne runneth along the Lip; another yet [n] creepeth vp the Temples and the forehead, and is conſumed into the muſcles of the Face. Of the Arteries of the Eyes we haue ſpoken before in the former Chapter, as alſo of the Noſe; of the Teeth a little before, whence it is that wee often finde pulſing or beating paines in them, ſuch as wee feele in inflamations of fleſhy partes, and this was *Galens* obſeruation in the 8. chapter of his fift Book *de compoſitione medicamentorum ſecundam loca*, who found in himſelfe not onely the paine of his Teeth, but alſo their beating or pulſation, wherefore he affirmeth confidently that there is one kinde of paine in the gums and another in the ſubſtance of the Tooth, and without the inflamation of the Gummes ſometime in the proper body of the Tooth, ſometimes in the Nerue paines doe perplex vs. And truely if there were no Artery at the roote of the Teeth, how could it bee that when a Tooth is perforated, ſo much cleare and perfect bloud ſhould yſſue out from it? Which as *Euſtachius* ſayth he obſerued in a man who had ſo great a fluxe of bloud from his tooth that almoſt powred out his life therewith. *Galen.* That there are arteries in the teeth. *Euſtachius his obſeruation.*

Finally, which wee alſo partly remembred before, from the greater and inner bough of the ſleepy artery which runneth vnder the Choppes, ſome ſurcles are communicated to the Throttle and Tongue to conuay vnto them life and heat: and thus much of the diuarication of the *Soporary* or ſleepy arteries both without the Scull and within: it remayneth that we ſhould entreat of the *Axillary* and *Crurall* arteries, as they are diſtributed into the ioynts, but we will begin with the Axillarie.

CHAP. XIX. *Of the arteries of the Hand in the large acception.*

THE great Artery after it is out of the Cheſt diſtributeth foure branches from each ſide of the Axillary; the firſt from the backeſide to the Muſcles ſituated vpon the ſhoulder blade; [table 20. fig. 2. I] another from aboue from the ioynte of the Arme with the blade, which the *Humerarie* veine accompanyeth for a time, [k] the third to the Muſcles that lye vpon the forepart of the Cheſt, [l] the fourth runneth downeward along the ſides of the Cheſt [M] and communicateth ſmal branches to the glandules vnder the arm-pits betwixt the third branch and the fourth, of theſe we haue ſpoken before: the remaynder is conuayed vnto the hand [from [N].] 4 branches from the axillarie.

For this branch [N] deſcending through the inſide of the Arme together with the *Baſilica* veine [tab. 20. fig. 1.[m]] betwixt the muſcle called *Biceps* or the two headed muſcle, diſtributeth ſmall ſurcles on either ſide to the muſcles which take vp the inſide of the arme. [vnder [M]] Afterward being accompanyed with the *Deepe-veine* [tab. 20. fig. 1.[q]] or the inner branch of the *Baſilica* (whereto it is faſtned in his whole courſe) as alſo with the fourth

Table 20. Fig. 2. sheweth the branches of the great Artery running thorough the whole Hand.

TABVLA XX.

G. The Mammary artery fastned on the outside into the breast-bone.

H, The Artery of the neck called *Cervicalis* going to the backeward muscles of the neck.

I, *Scapularis* going to the muscles of the shoulder-blade.

K, The Artery climbing vnto the top of the shoulder.

L, *Thoracica superior* going to the muscles that ly vpon the brest

M, *Thoracica inferior*, creeping along the sides of the Chest.

N, The axillary arterie attayning vnto the arme, and bestowing small branches to the muscles.

O. It attaineth to the outside of the cubit.

PP. Vnto the ioynt of the cubit.

† The by-partition of the Arterie vnder the bought of the Cubite.

Q An vpper branch of the artery carried along the Wand.

R. A surcle going vnto the vtter sides of the Hande, where wee vse to feele the pulse.

S. The lower branch of the Artery running along the *Vlna*.

* A small branch to the muscles about the little finger.

T. The distribution of the vpper and inner braunches into the hand and into the fingers.

Nerue of the arme it runneth through the backside into the outside of the cubit vnder the heads of the muscles thence arising, and shooteth foorth small branches aboue and below [O] and neere the bent of the elbow it affoordeth on either side two branches tothe ioynt [PP] where the pulse may be oftentimes euidently felt.

Galen. The Anastomosis of the vessels.

VVe saide that the Artery runneth with the veine, *For it is certaine* (saith *Galen* in the 10 and 17 chapters of his sixt Booke *de vsu partium*) *that in the whole body there is a mutual Anastomosis or inoculation betweene them*, that is, their mouths open one into another, *& so a Conspiration and Communion of their matters*. For the arteries doe impart vnto the bloode spirites and vitall heate, and for retribution the arteries draw out of the veynes blood which is the nourishment not onely of their spirits but of the arteries themselues; and these coniunctions of the vessels made by their orifices or mouthes are found especially in the armes and the legges, and therefore it hapneth sometimes that one only vein being wounded, not onely all the naturall blood of the bodye but togerher with it the vital also issueth, & so the wounded man perisheth. And this *Galē* also intimateth, for going about to demonstrate the vnions of the vessels, he saith, that if the greater veins be wounded, if the blood be suffered to flow foorth, the Arteries also will bee euacuated by conseqution: and this apeareth true by experience. For if you open a man that dieth of bleeding, you shall finde not onely the veines but the arteries also empty. But I return from whence I haue digressed.

Galen.

The Axillary Arteries descent.

The Axillarie Artery vnder the bent of the Cubit when it hath run a little way thorough the inside of the Cubit, descendeth into two bending muscles of the fingers, and is diuided into two notable branches; *Columbus* addeth oftentimes into three. The one is the vpper and passeth along the *Radius* or wand [R] till it come in a straight line vnto the wrest, at which place the Physitians commonly feele the pulse, making estimation of the disposition of the hart from the Dilatation, Contraction, and intermediat Rest of the artery,

tery. Yet saith *Columbus* this is not alwayes seated in the inside of the wrest, but runneth sometimes outward, so that if a Physition be ignorant of Anatomy, and search for the sicke mans pulse only in the vsuall place which is in the inside of the wrest a little aboue the roote of the thumbe, not finding it, hee will determine that the Patient is neere his death, when haply the artery beateth well on the vpper side against that place. The pulse in the wrest. Note this.

Before the artery of the pulse get vnto the fingers it sendeth a shoote toward the outside of the hand [Tab.20,ᵃ] betwixt the first bone of the thumbe and that of the Afterwrest whereby the fore-finger is supported, & distributeth it into the muscles of that place. Afterward it goeth vnder the Annular or transuerse ligament, & the tendon of the muscle of the Palme (as also do the veyne and the nerue fastened therto) and is diuided into three branches. The first of these offers two surcles to the inside of the thumb, the second to the inside of the fore finger, the third is vndiuided and attaineth to the middle finger, [Tab.20, betweene ᵃ and ᵗ.] Three branches to the fingers.

The other and inferior branch (of which *Columbus* maketh no mention) [Tab.20,ᵗ] runneth directly along the *Vlna* or *Ell*, and attaineth likewise to the wrest, at which place also we may feele the pulse to beate, especially if the party be leane, or haue a great pulse, and this is the reason why we rather touch the other artery then this, for the other is lesse couered by the tendons and offereth it selfe more manifestly that we may giue the better iudgement by it. The lower branch of the *Axillary*.

This branch also runneth vnder the fore-saide transuerse ligament into the palme of the hand, and before it reach vnto the fingers affoordeth a small branch [Tab.20,*] to the muscles that are seated neere the little finger. The remainder accompanied with a veyne and an artery is communicated to the fingers; the middle finger hath one surcle, the ring-finger and the little finger each of them two. The outside of the hand as it wanteth muscles so it wanteth arteries also, vnlesse it be that branch which is marked with R. His diuision

And thus much of the Arteries of the Hand.

CHAP.XX. *Of the Arteries of the Foote in the large Acception.*

WEe saide before that the great Artery about the lower spondels or rack-bones of the Loynes, or aboue the beginning of the *Os sacrum* or holy-bone is diuided into two notable Iliacke branches. [Tab.21,ᵐᵐ] Each of these is againe subdiuided on eyther side into two others, one exterior the other interior. [Tab.21,ξο.] The diuision of the Iliack Arteries.

The interior [ξ and Tab.17,ᵖ] shooteth out two scions, one externall [° and tab.17,ᵘᵘ] called *Musculainferior*, the lower Muscle artety which runneth ouerthwart and is consumed into the muscles that couer the outside of the haunch bones and the ioynt of the hip, The other internall, [ᵠ and tab.17,ᵘᵘᵘ] called *Hypogastrica*, which runneth directly downward and sendeth his surcles to the parts of the *Hypogastrium* or *Water-course*, as the bladder, the wombe, &c. The remainder of this branch [Tab.21,ξ] descending [vnder ɔ] first admitteth the vmbilicall artery of his own side; after it assumeth a portion from the outward branch of the first diuision [neere ᵖ;] and so increased it passeth through the hole of the share bone into the leg, and is distributed into the muscles which occupy the share-bone; thirdly in the end it ioyneth [tab.21,ᵠ] with another artery. [ϯ.] The vtter branch or the stocke it selfe running downeward accompanied with his veyne whilest it is yet in the belly [aboue ɔ] sendeth one branch vpward and outward through the cauity of the *Abdomen* called *Epigastrica*, [tab.21,ᵠ, tab.17, char.12,] vnto the muscles thereof, and another inward called *Pudenda* [tab.21,ᵛ tab.17, char.15,] which issueth from the Artery somtime within the *Peritonæum*, sometimes without, and runneth along the share-bone, but of these we haue spoken before in the 15 chapter, and repeated them briefly heere to make better way vnto that which followeth.

The Iliacke trunke of the great artery when it hath passed through the *Peritonæum* and the cauity of the belly into the thigh, is called *Cruralis*, [tab.21,ᵖ tab.17, char.16.] & from it branches on eyther side are propagated and disseminated into the whole foot, eight in number.

The first is called *Musculæ Cruralis exterior*, the vtter crurall muscle Artery. [tab.21,ϰ,] It issueth out of the outside of the crural trunke, and running downeward is consumed into the foure muscles that compasse the bone of the thigh. *Musc.Cru.exter.*

The second is called *Musculæ cruralis interna*, [tab.21,ϒ] because it riseth out of the in- *Musc.Cru inter.*

Table 21 Sheweth the distribution of the great Artery into both the feete.

TABVLA XXI.

λ, The lower mesentericall artery.

μμ, *Lumbares* which run in knots or knees into the spondels of the loynes.

νν, The diuision of the great Artery into Iliack branches aboue the holy-bone.

ξ, the diuisiō of the right Iliack into an inner branch at ξ, and an vtter at φ.

ο, *Musçula inferior*, An vtter propagation of the inner branch going into the muscles couering the ioynt of the *Coxendix*.

π, *Hypogastrica*, An inner propagation of the inner branch at ξ, going to the bladder, the yard, and the wombe, &c.

φσ, the coniunction at σ, of the vmbilicall veyne φ, with the branch, ξ.

ττ, *Epigastrica*, which is sent vpward into the right muscles of the *Abdomen*.

υ, *Pudenda*, which creepeth transuersly along the share-bone vnto the priuities.

φ, the externall Iliack branch.

χ, the outward crurall *Muscle-Artery*.

ψ, the internall crurall *Muscle-Artery*, which is sent to the muscles of the thigh on the inside.

ω, the coniunction of this Artery with a branch of the *Epigastricke*.

Γ, *Poplitæa*, or the artery of the hamme.

ΔΔ, Propagations of the surall Artery on eyther side going vnto the ioynt of the knee and three muscles of the foote.

Θ, *Suralis*, the artery of the Calfe which descendeth with the inner veine, and is diuided into three branches, Λ Σ Π.

Λ, *Tibiæa exterior* going vnto the muscles of the foot.

Π Φ, the lower & backer *Tibiæa* hidden within the muscles attaineth vnder the transuerse ligament to the vpper part of the foot at Φ, and is consumed into the muscles of the toes.

ΣΨ, the lower, the trunke of the crurall artery betwixt the heele and the inner artery, to which it offereth a branch marked with Ψ, which runneth to the vpper side of the foot.

Ω, the remainder of the Crurall artery going to the toes themselues betwixt the tendons of their muscles. *a b*; the diuision of the branch Ω, into an inner and vtter branch, *a b*. *c* the diuision of the interior branch into 5 to the great toe, fore-toe, and the middle toe. *d* the diuision of the exterior branch vnto the middle toe, the little toe, and the next vnto it.

side of the foresaide trunke sometime answering in opposition to the former, and is distributed into the muscles which occupy the inside of the thigh, and falling downe vnto the knee, a smal branch thereof is mixed [ω] with the last branch of the *Hypogastrick* artery.

Poplitea. The third is called *Poplitæa*, [Tab. 21, Γ] the crurall trunke creeping downeward vnder the hamme being accompanied with a large veine maketh this propagation: some surcles thereof run out into the back-ward muscles of the thigh, the rest descendeth a good way to the ham-veyne.

Suralis The fourth is called *Suralis*; the trunke lurking in the hamme or a little vnder it, shooteth out on each side a deepe propagation, [tab. 21, ΔΔ] which are consumed, partly in the ioynt of the knee, partly into three muscles of the foote which make the Calfe and take their origin all thereabouts. And these are the foure veynes which arise from the trunke in the region of the thigh, from hence it descendeth to the hamme [tab. 21, Θ] together with the interior veyne, partly to the leg, and partly to the foot; when it is drenched within the muscles of the leg it is diuided into three notable branches. [tab. 21, Λ Σ Π.]

Tibiæa exterior The fift which is the first of these three [Δ] is called *Tibiæa exterior*, the outward leg artery. It is a notable branch arising from the outside of the trunke beeing accompanied with the larger branch of the vtter veine, and so descendeth along the Fibula or Brace, & is consumed into the muscles which occupy the leg as far as they are fleshy.

The

The sixt *Crurall* Artery is the second of the forenamed branches [ta.21.ε] and is called *Tibiæa posterior elatior*, the vpper and backer Leg artery. It yssueth a little below the former out of the backer and lower part of the trunk, and descendeth as far as to the commixtion of the tendons of the muscles that make the Calfe, being accompanied with the hinder branch of the *interior* veine. *Tibiæa posterior elatior.*

The seauenth which is the third and last of the aforesayde branches [Ta.21.π] is called *Tibiæa posterior et humilior*, the lower and backer Leg Artery. It ariseth out of the backeward and exterior part of the trunke, and being accompanyed through the membranous Ligament (with the fore-branch of the inner veine) which ioyneth the *Brace* vnto the *Leg*, it is hidde within the muscles, and runneth forward and downward further then the other two till it passe the transuerse Ligament and attayne to the top of the foote, [Table.21.ϙ] from whence it is disseminated into the muscles that leade the Toes backeward, at which place *Vessalius* and *Platerus* say that the pulse may be easily felt. *Tibiæa posterior & humilior.*

The eight Artery of the Leg is nothing else but the remaynder of the *Crurall* trunke descending along the backeside of the *Tibea* or Leg, [tab.21. the lower ε] betwixt the 2. and 3. muscles of the Toes, and so it passeth betwixt the heele & the inner ankle vnto the soale of the foot, but at the inner ankle it offers a branch to the foote, [ta.21.ϟ] which reacheth to the muscle of the great Toe, and creepeth a good way vpon the top of the foot. What the eight artery is

That which is left [Ta.21.ϙ] amongst the tendons of the muscles of the Toes, is deuided into two branches [ab] each of which departeth into 5. surcles: for the inner branch [c] affordeth two to the great Toe, two to that next it, and one to the middle. The exterior [b] offereth two to the little Toe, two to that next it, and one to the middle Toe [d] and the lower side thereof.

And thus much concerning the distribution of the great Artery throughout the whole body. It remayneth that wee come vnto the third sort of vesselles which are the nerues, for whose prosecution we haue set aside the third part of this Booke.

The third part of the Eleauenth Booke
concerning the Nerues.

CHAP. XXI. *Of Nerues in Generall.*

AS the Naturall Faculty together with the Bloud and the thicker Spirit is deriued through the Veines; the Vitall with Bloud and a thinner Spirite through the Arteries as through Canales and Water-courses into all the partes of the body: so the Animall Faculties, that is, of *Sense* and *Motion* are conuayed into those parts which are capable thereof with a subtle and fine Spirite along by the Nerues as it were by the strings of an Instrument.

The Natures, Vses and Diuisions of the Veines and Arteries wee haue vnfoulded in the two former parts of this Booke, and are come in this place to the structure, differences and diuarications of the Nerues.

The Grecians call Nerues τόνους καὶ νεῦρα, the acception of which words among the Phisitians is manifould. *Erotianus* thinketh that *Hippocrates* vsed the word τόνους for all sortes of vessels, Veines, Arteries and Nerues.. *Galen* in his first Booke *de motu musculorum*, in the beginning of his Booke *de ossibus* and in many other places, maketh three kindes of Nerues which appeare without bloud and without any hollownes. The names of Nerues and their kinds.

Of these Nerues some proceede out of Bones, others out of Muscles, others are deriued from the Brayne and the spinall Marrow. Those which yssue out of the Bones & their protuberations are called σύνδεσμοι, *Vincula*, Tyes, Bands or Ligaments. Of these we shall heare particularly in the next Booke. Those Nerues that yssue out of Muscles are parts of the Muscles, and are called ἀπονευρώσεις καὶ τένοντας, that is, neruous propagations and Tendons.

Now a Tendon is nothing else but an excressence or out-growing of the Fibres of a Ligament and a Nerue, which being sprinkled through the flesh doe meete together as it were in one Chord, by which chord the Ioynts are ledde according to the good pleasure

ſure of our will. The third kinde of Nerues are thoſe which the Phiſitians doe properly call νεῦρα καὶ τόνους, and that from their office; νεῦρα becauſe they doe *nutare ſiue flectere*, that is incline or bend, and τόνοι becauſe they doe *Tendere*, that is, ſtretch. Theſe Nerues do ariſe from the Brayne and the ſpinall Marrow, and are called by *Galen organa πρωτουργὰ*, Inſtruments of Senſe and voluntary Motion, becauſe by them the animal Faculty and thoſe that moone within, that is, the impetuous ſpirites, are conuayed as it were by ſtrings or chords into the particular parts. *Auicen* cals them *Latores*, cadgers in our language. Of theſe *Hippocrates* wrote in his Booke *de locis in homine*, *The whole body is full of Nerues*, that is, throughout the whole body the Nerues doe run from the Braine and the Spinall Marrow, and in his Booke *de arte* he calleth them *meteors* in the fleſh, becauſe they are ſprinkled through the fleſh, that is, through the Muſcles.

Compared to-gether.

Galen in his firſt Booke *de motu muſculorum*, compareth theſe three kinde of Nerues among themſelues on this manner, A Ligament is inſenſible, a voluntary nerue of moſt exquiſite Senſe, and a Tendon of a middle nature, not altogether inſenſible, becauſe it hath ſome filaments or ſtrings of Nerues therein, neyther yet of ſo quicke a Senſe as is a Nerue.

There are alſo many other parts in the body, which becauſe of the ſimilitude betwixt them and Nerues are called *neruous*, although they cannot bee referred to any of theſe three kinds: ſo we ſay the wombe, the bladder and the guts are neruous, as alſo the vreters, the paſſages of the choller, and the eiaculatory veſſelles. In this place we take the name of a Nerue properly for an organ by which the animall ſpirit and the faculty floweth into the whole body. The nature of this organ may thus be deſcribed.

The deſcription of a nerue

It is a common Inſtrument of the body like a Chord, white, round and long without any cauity which our ſenſe can diſcerne (vnleſſe it bee the Optickes) but porous, in ſome vnited, in the greater nerue made vp of many ſmall ſtrings, & carrying as a Canale and motion which are conducted by the animall ſpirit from the Braine and the Marrow thereof vnto thoſe parts of the body which are capeable of ſenſe and motion.

Their ſubſtãce

Their ſubſtance is white and marrowy, much like the marrow of the braine, from which they take their originall (for I account the marrow of the Braine and the backe to bee of one and the ſame ſubſtance) but more compact and faſter, for it was neceſſary the braine ſhould be very ſoft becauſe it was to receiue the ſpecies or formes of ſenſible things. So that by how much the nerue deſcendeth lower or is more ſeparated from the brain, by ſo muchdoth it become the harder, that it might be better able to endure outward iniuries.

Membranes.

They are inueſted with a double membrane, produced from the two Meninges or Membranes of the braine, the vtter whereof is the thicker produced from the *dura mater* whoſe office is to ſafegard and defend the marrow of the Nerue, and if it conſiſt of many ſmall chords or threds it ioyneth them altogether, and when it hath encompaſſed them about it receiueth into it branches from the neighbour-veines.

Fernelius.

The inner membrane is thinner by much, and lyeth next vnto the marrowe or ſubſtance of the Nerue. It ariſeth from the *pia Mater* and hath the exquiſite ſenſe of touching, which ſaith *Fernelius* it communicateth to the parts whereinto the nerue is inſerted; for as the Braine is couered with theſe two membranes, ſo alſo are the nerues throughout the whole body, a nerue being nothing elſe indeede but a production of the Braine. But this threefold ſubſtance of a nerue, as *Falopius* hath it in his obſeruations and out of him *Bauhine*, may better be diſtinguiſhed by reaſon then by ſenſe, for Anatomy is not able to ſhew the difference betwixt the harde and ſoft membranes of any nerue except it be the optickes.

Which is their chiefe part.

The ſubſtaunce which is in the middeſt or in the center of the nerue is the principall part thereof and performeth the action, for the ſenſatiue and motiue faculty is conuayed from the Braine vnto the parts, not by the coates but by the marrow. Hence it is ſaith *Galen* that if you cut aſunder the marrow of a nerue, preſently the part into which that nerue is inſerted is depriued of ſenſe and motion; as for the membranes they do the ſame office vnto the nerue which they did to the Braine, for the nerues are not properlie the inſtruments of ſenſe and motion (for the immediate organ of motion is a Muſcle) but they are like pipes by which the whole ſenſatiue ſoule and the faculties thereof both of ſenſe and motion are led by the guidance of the Animall ſpirit from the Brayne vnto the parts of the body as they ſtand in neede either of ſenſe and motion, or therefore the Phyſitians do vſe to call them the organs of ſenſe and motion. For they communicate

vnto

vnto thoſe parts into which they are inſerted either ſenſe alone, or onely motion, or both together, for no part hath ſenſe or voluntary motion without a nerue; & if the nerue that belongeth to any part be compreſſed, or intercepted, or cut aſunder, or corrupted, the ſenſe and motion of that part doth ſodainly periſh.

How a Nerue is the Organ of Senſe.

Hence it is as *Ariſtotle* alſo remembreth in his third Booke *de Hiſtoria Animalium*, that no part of the body hath any ſtupor or dulneſſe, any palſie or reſolution, any ſpaſme or convulſion that hath not a Nerue in it. Now ſtupor is a diminution of ſenſe, the palſie a priuation of ſenſe and motion, and a Convulſion is a motion involuntary or againſt our willes.

The reaſon of the ſoftnes or hardneſſe of a nerue.

Galen in the third and fift chapters of his ſixteenth Booke *de vſu partium* ſayeth, that thoſe nerues which were made for voluntary motion are hard, and thoſe that were made for ſenſe are ſoft: and that the ſofte nerues do make for ſenſation and the hard for motion, nay he goeth further in the eight chapter of his 7 booke *de Adminiſtrationib. Anatom.* and affirmeth that the ſoft Nerues are onely fit for ſenſe but vnfit for motion. Some again conceiue and not without great reaſon that the ſoftneſſe or hardnes of a Nerue is diuerſly occaſioned, firſt from the ſubſtance whereout they yſſue, and ſo the firſt nerues which are ſaide to ariſe out of the Braine are the ſofteſt, thoſe harder that ariſe from the ſpinall marrow, and thoſe hardeſt of all which ariſe from the marrow contained in the racke-bones of the Loines and the Holy-bone: Secondly in reſpect of their production, ſo thoſe Nerues are ſoft which run but a little way, as if their iourney be not out of the ſcul, whereas thoſe that are led further off as vnto the muſcles are harder then they were at their Originall.

In like manner thoſe that run anfractuouſly, that is, with turnings and windings are very hard, as a branch of the third paire of the Braine. Againe, thoſe are hard which paſſe thorough a hard body; as that ſurcle of the fift coniugation which creepeth through the hole of the Temple-bone which the Ancients called *Cæcum* or the blinde-hole is made harder by the contaction of the bone then his beginning was. *Galen* attributeth the cauſe of hardneſſe and ſoftneſſe to the counſell of Nature, becauſe, ſaith he, the inſtrument of Senſe needed a ſoft nerue; A nerue as a Canale to leade along the Animall and ſenſatiue ſpirit, and a ſoft nerue becauſe it was to be affected and to ſuffer ſomwhat from the ſenſible obiect applying vnto it from without.

Galens opinio.

Nowe, becauſe that which is ſoft is fitter for paſſion, that which is hard for action, therefore, ſaith he, it was neceſſary that the inſtruments of the ſenſes ſhould haue ſofte nerues communicated vnto them, and the parts which were to be mooued by voluntary motion ſhould haue harder nerues. And this hee prooueth becauſe vnto thoſe Inſtruments of ſenſe which haue not only ſenſation but motion there is a double kind of nerue communicated, one for Senſe, another for Motion; as wee ſee in the eye vnto which the firſt coniugation is allowed for Senſe and the ſecond for Motion, ſo in the tongue which receiueth the third and fourth coniugations (ſo Anatomiſts do vſually diſtinguiſh them) for Taſting and the ſeuenth for Motion.

Bauhines opinion. His reaſons.

By the way hence it appeareth, that Nerues beſide their vſe haue alſo an animall action becauſe they are affected by the obiect, and therefore the ſofter nerues are fitter for Senſe and the harder for Motion. Notwithſtanding all this ſaith *Bauhine* yet wee conceiue that the nerues of their owne nature are indifferently diſpoſed both to ſenſe and to motion; ſo that they may be called *Sentientes* or *Motores*, *perceiuers* or mouers from the inſtruments or parts vnto which they are conducted and in which they are diſſeminated, for if they be inſerted into the inſtruments of motion, that is, into the muſcles, then are they called *Motorij* or mooning nerues. If into the inſtruments of Senſe then are they called *Senſorij* or *perceyuing* nerues; yea we ſee that one and the ſame nerue doth conuey motion and ſenſe according to the diuerſity of the inſtruments, for example; the ſeuenth Coniugation of the Braine conueyeth vnto the Membranes of the bowels which are in the middle and lower belly the Senſe of Touching, and yet the ſame paire being on either ſide reflected makes the recurrent nerue which diſtributeth ſurcles into euerie muſcle of the Larynx or Throttle to mooue the ſame. And if the ſame nerues ſhoulde meete with the inſtruments of Seeing, of Hearing and of Taſting, the ſame perceiuing & mooning nerues would alſo become ſeeing, hearing and taſting nerues.

An Inſtance.

In like manner the nerues which are conueyed to the muſcles to affoorde vnto them voluntary motion, do together with that power affoord vnto the membranes of the muſ-

cles

cles, into which their fibres do determine, the ſenſe of Touching, and ſo it commeth to paſſe that by the mediation of the nerues, the braine is to bee found in euery part of the body, becauſe the animall faculty which is ſeated onely in the braine, doth notwithſtanding transfuſe it ſelfe through the nerues.

The vſes of the Nerues.

Although out of that which hath been ſaid we may eaſily collect the vſe of the nerues, yet it ſhall not be amiſſe to remember that *Galen* in the ninth chapter of his fift booke *de vſu partium*, and out of him *Veſalius* in the firſt chapter of his fourth book makes a three-fold vſe of them.

The firſt to conuay ſenſe vnto the inſtruments of ſenſation, to the eyes, to the tongue, to the eares, and beſide theſe to the palmes of the hands and the inſides of the fingers, yea to the vppermoſt mouth of the ſtomack alſo, for theſe after a ſence are organs of ſenſation. For the beſt iudge by touching is the hand, and the mouth of the ſtomacke hath an exquiſite ſenſe of the want of aliment which wee commonly call *Hunger*.

The ſecond vſe is to affoord motion to the moueable parts, ſo the muſcles which are the inſtruments of voluntary motion haue nerues conuayed vnto them, and becauſe they were made to moue the whole members therefore their nerues are great and large, and becauſe the ſame muſcles ſtood in need of the faculty of diſcerning Tactile qualities for the ſecurity and preſeruation of our liues, therefore alſo they had nerues by which nerues they haue this faculty of ſenſation.

The third vſe is that for which all other parts haue nerues, to wit, that they might perceiue thoſe things which would be greeuous vnto them: (although this vſe may wel be referred to the former) for ſo wiſe, ſo iuſt, ſo skilfull is Nature ſaith *Hippocrates* (wee ſay the great God of Nature) and ſo prouident for the behoofe of the creatures, that ſhe hath diſtributed nerues to all the parts although not in the ſame meaſure, but to ſome more liberally to other with a ſtrayter hand, and that according to the proportion of their magnitude, of the dignity of their actions, of the intention or remiſsion of their motions, of the aſsiduity or intermiſsion of their vſes. So making an exquiſite eſtimate of the neede of the dignity and of the vſe of euery part, to ſome ſhe hath allowed greater nerues, to ſome leſſer, but to euery one that is fitteſt for it.

The magnitude of nerus.

For there is great difference betwixt the magnitude of nerues; the thickeſt are thoſe which are diſtributed vnto the remoteſt places, and into the moſt parts, ſuch are they that are ſent vnto the ioynts, which becauſe they needed greater aboundance of ſpirits haue a greater proportion of originals of ſinewes granted them out of the ſtocke of the ſpinall marrow which is in the rack-bones of the necke and of the loines, that from their marrow they might receiue a competency of ſpirits as it were by many rootes, which yet being gathered together do make one thicke nerue, but are againe though almoſt inſenſibly diſtributed into leſſer branches. Thoſe nerues are Meane which are conuayed to the organs of the ſenſes in the head: for being neare vnto the braine and very ſoft, they could not be very ſmall. Thoſe nerues are ſmall which are diſtributed into the next parts, as into the muſcles of the face. We will alſo ſay ſomething concerning the originall of nerues.

Their originall.

The originall of the nerues is not from the heart though *Ariſtotle* ſo conceiued in the fift chapter of his third buoke *de hiſtoria Animalis* and in the fourth of his third *de partibus Animalium*, for in diſſection we meete with no nerue produced therefrom, and thoſe that are led vnto it from the ſixt coniugation of the braine are ſo ſmall, that *Veſalius* witneſſeth that he could finde but one, and that with great difficulty.

Neyther haue they their originall as *Eraſiſtratus* thought in his youth out of the *Dura mater* or thicke membrane of the braine as their ſubſtance already declared doth ſufficiently witnes. But as *Hippocrates*, *Eraſiſtratus* when he was wiſer, *Herophilus*, *Galen*, and moſt Anatomiſts do agree from the braine, from which alſo the ſpinall marrow draweth his original. From the brain I ſay, which is manifeſted as wel by ſenſe in the diſſection thereof, where we ſee many riuers of nerues in the braine, to which thoſe of the body are continuated: as alſo becauſe their ſubſtances are marrowy alike and cloathed each of them with two membranes.

Moreouer the affects or diſeaſes of the head doe manifeſtly proue that all Senſe and motion doe flow from the Brayne. So in the Apoplexy which is cauſed by an obſtruction of the paſſages of the Brayne, the Animall Faculty is inſtantly intercepted, albeit the heart be altogether indempnified. So in the Epilepſie or Falling ſicknes where the mar-

row

row of the brayne from whence the nerues do yſſue is affected, the whole body is drawn into Convulſion, which is nothing ſo when the heart is affected.

An original double.

But we ſayde before that a beginning is double, one of Generation another of Diſpenſation. In reſpect of their Generation their beginning is Seede, of which as of their immediate matter they are framed. In reſpect of their Diſpenſation their beginning is in the brayne, together I meane with the After-brayne, which is the originall *à quo* from which. Thoſe Pipes if ſo you liſt to call them, which receiue Senſe and Motion are diſtributed into the body, as the part ſtandeth in need of the one, or the other, or both.

The differences of nerues.

Againe, the Nerues are ſayde to be of two ſorts, ſome proceeding from the brayne, ſome from the ſpinall marrow, and of theſe againe ſome from the beginning of the Spinall marrow, that is, being yet contayned in the ſcull, others in the Spinall marrow which is in the Rack-bones of the Chine. Againe, of theſe ſome belong to the marrow of the Necke, ſome of the Cheſt, ſome of the Loynes and ſome of the *Oſ ſacrum* or Holy-bone, to which alſo we may adioyne the nerues of the Ioynts.

Bauhines opinion of the originall of nerues.

Bauhine in this place interpoſeth his owne opinion, which is, that all Nerues doe yſſue from the marrow of the brayne oblongated or lengthned out, ſome whileſt it remayneth yet in the Scull and ſome after. But withall hee maketh mention of diuers opinions both of the Ancient and late Writers concerning the originall of the Nerues, which diſcourſe of his we will here tranſcribe but contract it as briefly as we can. Hee reckoneth therefore eight opinions, for the ninth we thinke not worthy to be remembred.

8. ſeueral opinions quored by him.

Hippocrates.

The firſt is of *Hippocrates* in his booke *de natura oſſium* in the very beginning, where he ſayth that the original of the nerues is from the Nowle vnto the Spine, the Hippe, the Share, the Thighes, the Armes, the Legs and the Foote.

Ariſtotle.

The ſecond is *Ariſtotles*, who in many places deliuereth that they ariſe from the heart, becauſe in it there are aboundance of nerues (for which hee miſtooke the fibres) and becauſe from thence motions doe ariſe, and vnder his Enſigne *Alexander*, *Auicen* and the whole ſchoole of the *Peripateticks* doe merrit or band themſelues. This opinion of *Ariſtotle*, *Auerhoes* and *Aponenſis* with ſome others doe maintayne indeede, but with a diſtinction, affirming that they iſſue from the hart, *mediante cerebro*, by the mediation of the brayne, or that they ariſe from the heart and are multiplyed and propagated in the brain.

Praxagoras.

The third is that of *Praxagoras*, who thought that the Nerues were nothing elſe but extenuated Arteries.

Eraſiſtratus.

The fourth of *Eraſiſtratus*, who thought they yſſued from the *Dura menin*x, but in his age he changed his mind as *Galen* witneſſeth of him.

Galen.

The fift is *Galens*, who determineth that the Nerues and the Spinal marrow doe proceede from the brayne.

Veſſalius.

The ſixt is that of *Veſalius*, who ſaith that ſome Nerues iſſue out of the Scull, others out of the Racks of the Spine; thoſe that proceede out of the Scull doe ariſe from the *baſis* of the forepart of the braine or from the beginning of the Spinal Marrow before it enter into the ſpondelles. The reſt from the Spinall marrow remayning within the Racke-bones.

Falopius.

The ſeauenth is *Falopius* his opinion in his obſeruations, where hee ſayeth, that ſome Nerues (as thoſe that are ſoft) doe ariſe from the brayne or the marrow within the Scul, others from the Spinall marrow.

Varolius.

The eight is *Varolius* opinion, who ſayth that all Nerues doe take their original from the Spinall marrow which proceedeth from the brayne and the After-brayne, and with him doe *Platerus*, *Archangelus* and *Laurentius* vpon the matter conſent, as alſo doeth *Bauhine* as you haue heard before.

The Nerues therefore which yſſue from the Marrow of the Brayne contayned yet within the Scull are commonly accounted 7 paires according to *Galen*, ſome make nine coniugations which are called *Nerui cerebri* The Nerues of the Brayne, which may be expreſſed in this diſticke.

Optica prima, oculos mouit altera, tertia guſtat
Quartaque, quinta audit, vaga ſexta, ſeptima linguæ eſt.

The Opticks firſt, Eye Mouers next, the third and fourth doe Taſt:
The fift doth Heare, the ſixt doth gad, the Tongue claymes ſeuenth and laſt.

To which alſo we may adde the organs of Smelling.

Other

Other Nerues do ariſe from the ſame marrow after it is falne through the great hole of the Nowle-bone and runneth thorough the holes bored in the racke-bones of the ſpine where it is properly called *Spinalis medulla* the *Spinal Marrow*. And theſe are thirty paires or Coniugations, that is to ſay; ſeuen of the Neck, of the Cheſt or backe twelue; fiue of the Loines and ſix of the Holy-bone from which the nerues of the ioynts do ariſe. For the hand receiueth ſometimes fiue, ſome ſixe propagations from the fift, ſixt and ſeuenth paires of the necke, and from the firſt and ſecond paires of the Cheſt: the foot receiueth foure Nerues from the three lower paires of the Loines and from the foure, ſometimes the fiue vppermoſt of the Holy-bone which are called nerues of the ſpinall marrow.

30. pair of the ſpinall marow

Theſe nerues do yſſue on either ſide after the ſame manner, for no nerue is produced without his companion, and therefore the Grecians called them συζυγία, the Latines *Neruorum paria*, or *Coniugia* paires or Coniugations of nerues. All theſe Coniugations as they do ariſe alike, one from the right hand, the other from the left; ſo are they alſo diſtributed after one and the ſame manner, except onely the ſixt paire of the Braine, whoſe right nerue is not diuided as is the left, as we ſhall heare afterward.

And thus much ſhall haue bene ſufficient to haue ſaid in generall concerning the nature, differences, vſe and originall of the nerues. Now we deſcend vnto their particular Hiſtorie beginning with thoſe of the Braine, becauſe thence all nerues take their Originall.

CHAP. XXII. *Of the Nerues of the Eyes, or of the firſt and ſecond Coniugations.*

The Mamillary proceſſes.

THoſe two proceſſes of the Braine called *Mammillares* which are the Inſtruments of Smelling, do come to be handled in the firſt place, but beecauſe we haue related their Hiſtory and exhibited the Table which belongeth to them in the ſixteenth chapter of the ſeuenth Booke, we will referre the reader for his ſatisfaction vnto that place and proceede vnto the nerues of the eyes, whereof indeede we made ſome mention before, but that briefely and by the way, as alſo we haue done of the reſt of the nerues, becauſe they tooke their Original from the diuers partes of the ſubſtance of the Braine which was then the mayne ſubiect of our diſcourſe.

The nerues therefore of the eyes are of two ſorts: the firſt are called Opticks or *nerui viſorij*, becauſe by them we See. The ſecond are called *Oculorum motorij*, the moouing nerues of the eyes, for by them the eyes are wonderfully and ſodainly moued.

The Optickes are the firſt Coniugation of the Nerues of the Braine [Tab. 22. figure. 1 and 2 °] which are the thickeſt of all the Coniugations of the Braine, yea of all the reſt if they be not compounded of diuers filaments. And ſo much the thicker they were, becauſe ſaith *Galen* in the third chapter of his ſixteene booke *de vſu partium*, they haue ſenſible cauities, beſide of all the others they are the ſofteſt.

The Optcke Nerues.

Their original.

They ariſe vnder the middle of the baſis of the Braine, where the marrow beginneth to be lengthned. *Galen* in the third chapter of his ſixteenth booke *de vſu partium* ſayeth, they ariſe from both ſides of the forward ventricles to whoſe ends they are ioyned. Howſoeuer after their originall they run obliquely inward and forward, and when they haue gone a little diſtance, and as it were in the middeſt of their iourny, they are vnited aboue the ſaddle of the Wedge-bone [Tab. 22. figure. 1 H] not onely by interſection or ſimple contaction, but by a confuſion of their marrowes, beeing ſo mingled as they make one common body wherein the two nerues cannot be ſeparated one from another. Preſently after this confuſion they are againe ſeparated [Tab. 22. figu. 1 aboue H] running each of them obliquely outwarde by a hole of the wedge-bone, which was made of purpoſe, commonly accounted for the firſt hole of the ſame, and ſo getting out of the Scull, the right runs vnto the center of the right eye on the hinder part, and the left vnto the center of the left, as if they were the roots of the eyes. Notwithſtanding *Veſalius* and *Platerus* do not thinke that their implantation is into the center, but to the right ſide warde. In bruite beaſtes indeede they are not implanted into the center but much lower, for they looke not ſo much forward as ſideward. Theſe nerues are not diſſolued into Fibres as other nerues are, but are ſpred abroad within the eye, notwithſtanding *Veſalius* ſaith, that he hath obſerued them in Swine to conſiſt of many Filaments, as doe the Nerues of the Legges.

Their confuſion.

Separation.

The

The substance of the Opticke Nerue is double, Marrowey and Membranous, for the inner part is soft, which you shall perceiue will squeeze out if you presse the nerue hard whilest it is yet compassed with his membranes. Their substance.

Of this Marrowey substance diffused in the orbe of the Eye, is made that coate which is called *Amphiblestroides* or *Retina tunica*, from the resemblance it hath with a Net; [tab. 22. fig. 1. and 2. I] which notwithstanding to say trueth, is nothing lesse then a coate, because it differeth nothing at all from the substance of the brayne, compassing the vitrious humour round about and the middle part of the Eye, that so the visiue spirites might bee diffused through the cauity thereof. *Retina tunica.*

The membranes of the Optick Nerues are two: one from the *Pia mater* and another from the *Dura mater*, notwithstanding from their originall to the hole which is in the orb of the Eye and wherethrough they passe they are inuested onely with the *Pia mater*, from thence to the eye it selfe they assume another inuolution or vestment from the *Dura Meninx* which also is consumed into the horny coate as the membrane they haue from the *Pia mater* is spent into the grapie. Hence it is that by the continuation of this nerue in a very moment of time the Animal spirit is conuayed vnto the *Pupilla* or apple of the Eie, which is nothing else but the perforation or hole of the grapy coate. And therefore when one eye is shut we may easily discerne that the *Pupilla* of the other will be suddenly dilated, because of the affluence of the spirits. And by this demonstration *Galen* in the 4. chapter of his 7. booke *de placitis* maketh it manifest euen to the very Sense, that there is not onely a spirit but an Animall spirit in the body of man. Their membranes.

If it be demanded why Nature did so prouide, that when one Eye is shut the spirites should all accrew vnto the other. I answere, it was to accomplish the perfection of that Sense; for the concourse of spirites doe better receiue the impression of the obiect and conuay it to the Sense with more speede and certainty.

Concerning the counsell of Nature in vniting the Opticke Nerues, many men haue disputed diuersly. *Galen* thought it was, that one obiect might not appeare double, which conceite *Vessalius* dislikes and so doth *Archangelus*, who addeth, that if that had bin the reason, the Nerues of Hearing, of Smelling and of the rest of the Senses should haue beene vnited in the middle of their iorney, that one audible or odorable thing might not appeare double. Diuers reasons why the opticks are vnited. Answered.

The second reason, giuen for the vnition of the Opticks is, that one Eie being put out the creature might see with the other; but it is more reasonable to say that Natures first intention was, that both the eyes should alwayes remayne sound.

The third reason that when one Eye is shut all the visiue Spirites should hasten vnto the other to make the sight more acute or sharp. But it may be answered that one Nerue cannot contayne so much spirits as was in both. He that shoots at a marke in a Crosse-bow or in a Peece, thinks haply that he sees more sharply when he blinks of one eye then when he seeth his marke with both, but therein hee is deceiued, for indeede he seeth not his matke so well, yet is able to lay his leuell better, because hee seeth more directly when he lookes through a narrow hole.

The fourth reason some conceiue to be, that when we are constrayned to look through a narrow hole, or by the same right line by which both the eyes cannot discerne; in such a case the sight of both eyes might be vnited into one: But I doe not thinke (sayth *Archangelus*) that Nature had any such scope in her first intention.

The fift and last reason giuen of the vnition is the most probable, and that is, that these soft nerues might not be put to distres in the middle of their passage, wherto say the trueth they are in most danger, as well because of their notable cauities as also because of their softnes, for they walke through the moister part of the brayne, that is, the lower; and the faculty of seeing requires such a cauity and such a softnes. Thus far *Archangelus*. *Archangelus.*

They are called Opticke Nerues, that is, visiue from their action, because they communicate the visiue faculty or the sense of Seeing vnto the Eye. They are called also by *Herophilus meatus visorij*, because (sayth he) they onely are sensibly bored, which also *Galen* approueth, who sayth that they are manifestly perforated at each end. Many Dissectors are able to perceiue their perforation in the lower part where they touch the Eyes; but sayth *Galen* in the fourth chapter of the 7. booke *de placitis*, he that would descern the other perforation that is at their originall, must obserue three things. First that the creature which hee dissects bee great: secondly, that the dissection bee made presently after The names of the opticks.

death. Thirdly, that the ayer be cleare and lucide where he makes his diſſection. Hee addeth alſo in the ſame place a reaſon why it was neceſſary that theſe nerues ſhould rather be perforated then any other, and that is becauſe theſe nerues do leade along the animall faculty by animall ſpirits or by a ſpirituall ſubſtance. For the reſt they needed onely bee porous without any hole or perforation, becauſe the faculty in them is conuayed not by animall ſpirits but onely by a beaming irradiation. But the latter Anatomiſts with one conſent do deny any ſuch conſpicuous perforation. *Veſalius*, I neuer met with it although I haue cut vp dogs aliue and other large creatures onely for this purpoſe, yea ſaith hee I haue opened the head of a man within leſſe then a quarter of an houre after it was cut off, and haue carefully kept it warme with hot water, and yet could neuer find any ſuch perforation. *Falopius* in his obſeruations. The optickes are not manifeſtly perforated. *Columbus*, No pore or hole may bee ſeene in them neyther in an Oxe nor any greater creature. *Laurentius*, I neuer obſerued any conſpicuous cauity. *Volcher*, The opticke nerue is not made of a ſolid and perforated body, but of many neruous fibres bound and vnited by Membranes.

Whether the opticks be perforated.

Opinions of Anatomiſts.

Thus you ſee that the ſtreame of Anatomiſts runs directly againſt this opinion of *Galen*, and they render a reaſon, for ſay they, their ſubſtance being rare and ſoft, the ſpirit may eaſily paſſe through them vnto the eyes; yea all the ſinewes although they haue no viſible holes yet are they full of ſpirits, for the ſenſe is hindred both by compreſsion and by obſtruction. So if a nerue be intercepted with a band or tye, the part below looſeth ſenſe, for the ſpirits of the vpper part being ſeparated from the lower, there is no communion betweene them, but if the tye be taken away the ſenſe returneth. And hence it is, that when the opticks are obſtructed in that diſeaſe which the Arabians call *Gutta ſerena*, the action of ſeeing is vtterly taken away.

Queſtions concerning the ſpirits in the nerues.

But whether we are to beleeue that in euery nerue there is a ſpirit as there is a ſpirite in the braine, which being periſhed the whole creatnre becommeth ſtupid, and beeing ſtrong or plentifull ſerueth for the ſenſe and motion of the parts; and whether if there bee any ſuch ſpirits they be inbred and ſeated in the nerue of the part, and onely awaked by a meſſage from the braine, or whether at ſuch time as we would moue any member, the motiue ſpirit falleth from the braine into the nerue, we confeſſe with *Galen* in the place before quoted, that we are not able abſolutely to determine.

Bauhines determination.

Bauhine concludeth that theſe Nerues are not onely thicke and of a rare texture inueſted by both the membranes of the braine, and fit to giue way for the tranſportation of the ſpirits, but alſo ſaith he, wee beleeue with *Galen* that they are porous as will eſpecially appeare if they bee ſodden, and *Archangelus* ſaith, that in the coition of the opticke nerues there is a common cauity inſculped out of one into another. We ſay alſo with *Galen* in the eight chapter of his ninth booke *de vſu partium*, that the opticks in dignity are preferred worthily before the moouing Nerues of the eyes, becauſe the principall part of viſion or ſight conſiſteth in them.

Moreouer ſaith *Bauhine* whileſt they are yet in the Scul, certaine branches of the ſleepy arteries do on eyther ſide touch them, which obſeruation he tooke out of *Galen* in the place before quoted.

The vſe of the opticke nerues is one and the ſame according to all Anatomiſts, who heerein do accord with *Galen*, that through them the ſenſatiue ſoule and the viſiue ſpirits are conuayed out of the marrow of the braine into the eyes.

The vſe of the opticks.

The ſecond coniugation of the braine is of the Nerues that mooue the eyes [Tab. 22, fig. 1 and 2. K] diſtinguiſhed from the former coniugation onely by a thin bone. This coniugation is ſmall and fine, much leſſe then the former, and harder becauſe it is to bee inſerted into muſcles. It ariſeth out of the baſis of the marrow of the braine, and ſo runneth forward vnto the cauity of the eye, where it falleth out of the Scull through a proper hole accounted for the ſecond perforation of the wedge bone.

The ſecond coniugation of the eye-mooners. their original.

This hole is not round, as that which was bored for the optickes, but ſomewhat long, ſaith *Galen* in the eight chap. of his 9. booke *de vſu partium*, becauſe three nerues were to paſſe through it: This, the third coniugation or the ſecond branch of the third paire cõmonly ſo called, and the eight coniugation or the leſſer roote of the fift paire, and therefore *Columbus* and *Archangelus* call it *Fiſſuram orbitæ*, a cleft or chinke of the Orbe of the eye.

Where they paſſe the ſcul.

This moouing Nerue hauing perforated the bone, is faſtned to the Opticke, and di-

The diuiſion of this paire.

uided

uided into good large braunches which are conueyed to the ſeauen muſcles of the eie, ſaith *Veſalius* and *Platerus* to fiue muſcles of the eye, and to two of the eye-lid ſaieth *Columbus* and *Archangelus*; to foure onely of the eye, and that that lifteth vp the eye lidde, ſaith *Falopius* and *Laurentius*.

Bauhine particularizeth concerning their inſertion on this manner.

The firſt branch climbeth ouer the Opticke, and is diſſeminated into the muſcle that lifteth vp the eye-lid, and the Muſcle that lifteth vp the eye. The ſecond, is very conſpicuous vnder the Optick and is diuided into many ſurcles and diſperſed into the Muſcle which leadeth the eye to the inner angle. The third is bifurcated and inſerted in manie ſtrings into that Muſcle which draweth the eye directly downeward. The fourth is conuayed into the ſixt Muſcle which leadeth the eye round, or rowleth it vnto the vtter Angle.

There are alſo ſaith *Falopius*, and with him *Laurentius* and *Bauhine*, certaine ſmal and threddy Fibres, which accompanying the Opticke Nerue are diſſeminated into the externall Membranes of the eye. In ſome men, though it be not very ordinary ſaith *Columbus* and *Archangelus* (but *Falopius* and *Laurentius* deny it) ſome branches are ſent from this ſecond Coniugation to the temporall muſcle, whence it is that when that muſcle is offended the eye partaketh with it, and on the contrary. A conſent betwixt the 2. coniugation and the temporal muſcle.

The vſe of this Coniugation is to conferre the Mooving faculty vnto the muſcles & the tractiue faculty vnto the membrans of the eyes. Now the reaſon why when one eye is moued to one ſide, the other eye alſo followeth his motion neceſſarily, is to be aſcribed to the Nerues themſelues, which in their originall are continuall, that is, doe imediately ioyne together. And ſo much of the firſt and ſecond Coniugations which are the Opticke and mooving Nerues of the Eyes. Now we proceede. The vſe.

CHAP. XXIII. *Of the third and fourth Coniugations of the Braine.*

THE third Coniugation [Tab. 22. fig. 1 and 2 L] is ſent vnto the muſcles of the face and is commonly called the leſſer roote of the third payre. But ſaith *Bauhine*, becauſe it is neuer ioyned with the Coniugation following [Tab. 22. fig. 1 and 2 L with M] neither in the beginning nor in the progreſſe yet hath nothing common therewith, and becauſe it groweth out of order in reſpect of all the reſt, therefore ſaith he, it may worthily be called a peculiar Coniugation. The 3. coniugation. His originall.

It is ſaide to ariſe from that ſide of the baſis of the Braine where the ſpinall marrow takes his originall therefrom. [Tab. 22. fig. 1 D] But *Falopius* in his Obſeruations hath it thus and better. It ariſeth from the lower and backward part of the marrow of the Braine, or thoſe proceſſes thereof which are called the *Buttockes*. *Bauhine* addeth, that their originall is very ſmall, and runneth directly vnder the baſis of the braine to the ſide outward, and perforateth alone the *Dura meninx* on either hand. Then being faſtned to the ſecond paire [Tab. 22. fig. 1 K] it entreth into the orbe of the eye together with it by a perforation common to them both. And is diuided into four branches according to *Veſalius*, *Columbus*, *Platerus* and *Bauhine*. But *Falopius* aſcribeth theſe braunches to the two ſubſequent coniugations which we haue reckoned but for one. Diuiſion.

The firſt of theſe [Tab. 22. fig. 2 N] runneth vpward thorough the fat of the eyes and affoordeth a branch to the fift muſcle placed in the inner angle which compaſſeth it vnto the pulley. *Falopius* is of opinion in his Obſeruations that this whole Coniugation is beſtowed vpon this muſcle. But preſently after the branch wee made mention of before is beſtowed, it falleth through a peculiar hole of the forehead bone to the skin of the forehead to giue it and the vpper eye-lid motion. The fourth Coniugation.

The ſecond branch of this coniugation [Tab. 22. fig. 2 O] is lower then the former & running downward paſſeth through a proper hole grauen for him in the fourth bone of the Iaw, at whoſe forepart it is diuided into many propagations diſtributed into the muſcles that moue the vpper lip, the Wing of the noſe outward into the lip it ſelfe, and the gums of thoſe teeth that are called *Inciſorij* or the *ſhredders*.

The third branch [Tab. 22. fig. 2 P] iſſuing thorough the ſecond hole of the vpper iawe, behinde the Caruncle ſeated in the angle of the eye, attaineth the cauity of the noſthrils where it is conſumed into their coate, [Tab. 22. fig. 2 the lower P] and affordeth a branch to the Membranous muſcle of the noſe which contracteth the wing thereof.

The fourth branch [Tab. 22. fig. 2 Q] paſsing through the fiſſure which is betwixt the

Table 17. Figure 1 sheweth the basis of the Braine and After-braine freed from theyr Membrane, that the originall of the Nerues of the Brayne might be be ter perceyued.

Figure 2 sheweth one side of the Braine, the After-braine, the spinall marrow, and the Nerues.

TABVLA XXII.

FIG. I.

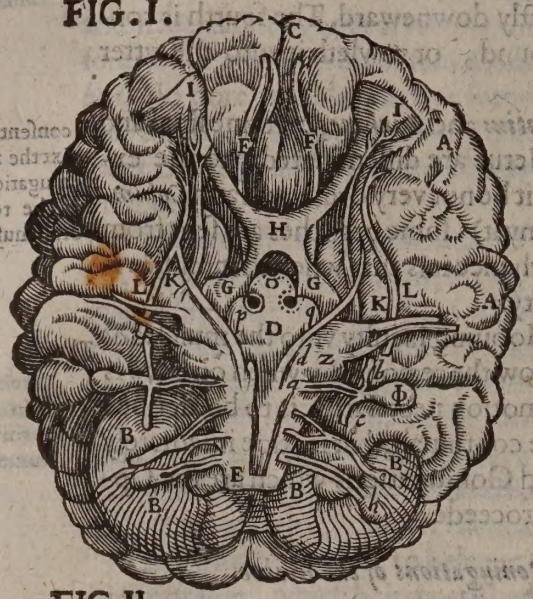
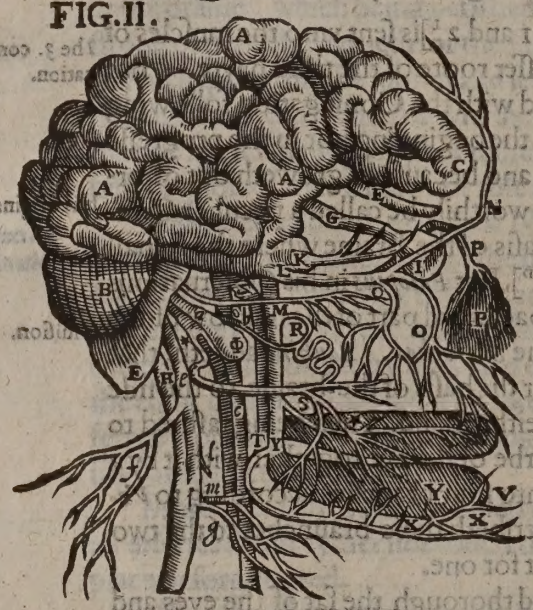


FIG. II.



GG 1,2. The Opticke *Nerues*.
H 1, The coition or vnion of the opticke nerues.
II,1,12. The coate of the eye whereinto the Opticke nerue is extended.
KK1,2. the second paire of sinews ordaind for the motion of the eyes.
LL 1,2, the third paire of sinews, or according to most Anatomists the lesser root of the third paire.
MM 1,2. the fourth paire of sinews, or the greater root of the third paire.
N 2. A branch of the third coniugation deriued to the musculous skin of the forehead.
O 2, A branch of the same to the vpper iaw.
PP, 2 Another into the coate of the nosethrils.
Q 2. Another into the temporall muscle.
R 2 A branch of the fourth coniugation crumpled like the tendrill of a vine.
S 2, A branch of the same reaching vnto the vper teeth and the gummes.
T 2, Another of the same to the lower iaw.
V 2, a Surcle of the branch T to the lower lip.
XX, 2. other surcles from the branch T to the roots of the lower teeth.
YY 2, the assumption of the nerue of the fourth coniugation vnto the coate of the tongue.
Z, 1,2. the 4 paire vulgarly so called which are spent into the coate of the pallat.
a 1,2. The fift paire of sinewes which belong vnto the hearing.
φ, The *Auditory* nerue spred a broade into the cauity of the stony-bone.
A hard part of the fift coniugation aboue the which may be accounted for a distinct nerue.
b 1,2. A small branch deriued from this harder part of the fift paire.
c 1,2. A lower branch from the same originall.
d 1,2. this nerue is commonly ascribed to the fift paire, but indeede is a distinct coniugation which we will call the Eight, because wee would not interrupt the order of other mens accounts.
e 1,2. The sixt paire of sinewes.
f, 2 A branch from them deriued to the necke, and the muscles couched thereupon.
g 2, another braunch to the muscles of the *larynx* or throttle.
h, 1,2 the seuenth paire of sinewes.
i 1, the vnion of the seuenth paire with the sixt.
l 2 A propagation of the seuenth paire to those muscles which arise from the appendix called *Styloides*.
m 2, Surcles from the 7 coniugation to the muscles of the tongue, the bone *Hyois* and the *Larynx*.

bone of the vpper iaw and the wedge-bone is consumed into the temporall muscle. And thus much of the third coniugation.

The fourth Coniugation.

The fourth coniugation belongeth to the tongue and are called *Nerui gustatorij*, because by them the sense of gustation or tasting is made. [*t.22.fi.2* M] This coniugation lieth close to the former in the progresse but not in the originall, and is called by them that thinke it hath his beginning from a double roote, it is called I say the thicker root of the third coniugation. It doth not proceed saith *Galen* in the eight chapter of his ninth book *de vsu part.* out of the backe parts of the Braine because those are harde, nor out of the sides because the way had not bene safe; but out of the basis of the Braine where the fore-part is tyed to the hind part, yea out of the marrow of the braine. And the reason of this originall is double: first, because it was most secure, and againe because it was the readiest to answere the position of the tongue; from thence it falleth directly downward thorough the sixt hole of the wedge-bone which is common to this and the following Coniugation, [Tab.22. fig.2,z] and from this presently after the outgate yssueth a propagati-

His Original.

on

on twisted or wrethed like the tendrils of a Vine, [tab.22,fig.1,s] that so, say some, it might by degrees become harder; or rather that the Animal spirit might haue a little stop or stay; and is vnited by two branches [Tab.22,fig.1,and 2,b c] with the auditory nerue. So giuing surcles to the muscles, of the face to the temporall muscles to the grinding muscles of the cheekes and to the skinne of the face.

When it hath allowed this wrinkled branch, it descendeth more downeward and sendeth forth a shoote [Tab.22,fig.2,s] which affoordeth surcles forward to the gums of the grinding teeth, and to the teeth themselues in their order, yet some doubte whither they passe as farre as the rootes of the teeth.

At the same time also there buddeth out of the backside a third propagation which *Falopius* calleth the fourth nerue of the third payre, [tab.22,fig.2,r] which is inserted into the muscle that lurketh in the mouth, and passing through the inner hole of the lower Iaw offereth surcles to the rootes of the lower teeth of his owne side, [Tab.22,fig.2,xx] and by the helpe of these nerues the teeth, whereas other bones haue no sense, do feele the occursation of things that are offensiue. The remainder of this coniugation [Ta.22,fig.2,x] neare the skinne, issuing through a hole bored in the foreside of the Iaw is communicated to the lower lip and to the skin thereof in many surcles.

From this nerue also before it get into the Iaw, there ariseth often a small sinew, slender indeede but strong and long which runneth vnder the Iaw till it come to the muscle which openeth the mouth, and to those which are placed vnder the Chin, and is inserted partly into the bone Hyois and partly into the tongue. The remainder.

Finally, the trunke it selfe [Tab.21,fig.2,y] which *Falopius* in his Obseruations calleth the fift nerue of the third coniugatiō, passeth through the muscles that lurke in the mouth, and beeing accompanied with the trunke of the other hand passeth vnto the side of the tongue and is consumed into the coate thereof to make it a fit organ to discerne the differences of sapors or Tastes, and from it certaine smal surcles are fixed into the substance of the tongue.

From this coniugation that which is commonly numbred for the fourth, by *Galen*, *Vesalius*, *Columbus*, *Platerus*, and *Laurentius* [Tab.2,fig.1,and 2,z] seemeth not to bee distinguished, not because it is neareſt to that before named, but because it taketh his original, though his surcles be many out of one place, and in one place onely perforateth the *Dura meninx*. For those paires or coniugations which are commonly numbred for the sixt & the seauenth although they arise from many propagations, yet because the surcles are vnited together and so vnited do fall through one perforation of the *Dura meninx*, are not accounted for double or manifold paires, for we thinke with *Falopius* that in the distinguishing of the coniugations of the nerues the holes of the Scul are not to be considered; for if this were to be obserued, then because the second and the third payres and the eight do passe through one and the same hole they should bee accounted all for one coniugation, which were yet neuer so accounted by any Anatomist. How to count the coniugations of the sinewes.

The originall of this nerue is lesser then the former neare vnto it and a little harder, & therefore *Galen* saith, that it springeth more out of the Basis of the braine as from a part thereof which is the harder. The originall of it.

Presently after the original, it passeth a little forward and is mingled with the third, with which it issueth at a common hole, and at the pallate is diuided into diuers branches into whose whole coate it is inserted, [tab.22,fig.2,the lower z] and giueth vnto it the sense of Tasting. *Galen* sayth it is somewhat hard because the coate which compasseth the mouth is harder then the tongue and other parts of the mouth; and in this respect his sense is the duller. Sometime two small branches, which descend neare the Almonds and the Appendix called *Styloides* vnto the roote of the tongue are distributed through his coate. And thus much of the fourth coniugation.

CHAP. XXIIII. *Of the Auditory Nerue or the fift Coniugation.*

THE fift Coniugation [Tab.22,fig.1,and 2.a] at the sides of the basis of the braine acording to *Galen*, ariseth out of the marrow of the braine elongated, and is made of two surcles or nerues. The one softer (and indeed the softest except the opticks) and neareſt to the Eare, the other harder. These two do together issue through the membrane & run into the stonybone, & many The fift coniugation.

thinke they are ioyned, accounting them for one nerue, for they say the fift Coniugation consisteth of a soft and a hard part, but indeede and trueth they are distinguished. [ta.22. fig.2. It appeareth vnder a] which also *Galen* and *Falopius* did obserue.

His double originall.

His out-gate.

Progresse.

This Nerue therefore runneth through a large but writhen hole in the stony-bone, appoynted properly for it, which is numbred for the fift perforation of the Temple-bone into the cauity which is like a Cony-burrough prepared for the Organ of Hearing. Presently after, the harder part runneth forward through a proper Canale or Pipe, being accompanied with an artery arising from that artery which is disseminated through the *dura meninx*, and through the same bone it returneth obliquely backeward, and falleth into that cauity wherein that *Timpanum* or Drum is, yet so that it alwayes buts vpon his owne bony Canale: from thence being more reflected it sendeth forth two shoots, one aboue and another below, both which do passe through by their proper holes. The vpper [ta. 22.fig.1.and 2.[b]] runneth ouerthwart through the hole, through which likewise a small veine passeth vnto the Organ of Hearing. And this shoote is mixed [ta.22.fig.2.[x]] with that branch of the fourth paire, or of the third according to common Anatomists, which we sayd was like the tendrill of a vine: but the lower [tab.22.fig.2.[c]] passeth out at a hole which is very streight and writhen, and being carried ouerthwart ouer the *masseter* muscle, is instantly mixed with the branch of the third payre that is like the tendrill of a vine, or to the propagation of the sinew that goeth vnto the Tongue, and from the Tongue is led along to the muscles of the Cheekes, and to the skinne about the roote of the outward eare; and haply this Nerue assisteth the Tast as well as the Hearing, and the reason may hence be deriued why those that are borne deafe are also borne dumbe. Sometimes when this Nerue hath gotten through the Blind hole it runneth downward as if it would accompany the sixt coniugation, [ta.21.fig.1.and 2.[c]] and sendeth small branches to the proper muscles of the *Larinx*, whence it is that becausse of the consent betwixt the Eares, the Tongue and the *Larinx*, a dry cough ariseth if we picke our Eares to deep. Sometime also it sendeth small braunches into the whole arme, with the fourth, fift and sixt nerues of the arme, yea oftentimes it accompanieth the spinal marrow, and sendeth his branches together with the nerues of the marrow into the whole foote. But the soft part of this nerue [table.22.fig.2.a] which is indeede *Neruus auditorius* the true Auditory Nerue accompanyeth the hard part, and when it hath attayned vnto the end of the forenamed, cauity it is dilated after the manner of a membrane, [Ta.22.figu.1.and 2.[o]] becommeth the chiefe instrument of Hearing, and there remayneth after the same manner that we mentioned before in the expansion of the Organ of Smelling.

His branches vnto the ioynts.

The true auditory nerue

CHAP. XXV. *Of the sixt, seauenth and eight Coniugations.*

The sixt coniugation.

THE sixt Coniugation [ta.22.fig.2.[c]] taketh his beginning from a few fibres a little below the originall of the fift payre or of the Auditory Nerue. But these fibres are presently and mutually vnited, and are thought to make one great nerue, whereas indeede they are not so vnited but that they remayne a good while two distinct Nerues contayned in one membrane which was the cause of the errour. They get out of the Scull at the second hole of the Nowle-bone by which the greater branch of the internall *Iugular* veine did ascend into the braine. The one of these Nerues is the *anterior* and the lesse, the other is the *posterior* or the greater.

His egresse

The lesser when it hath gotten out of the Scull descendeth directly vnto the muscles of the Tongue (to whose roote it affoordeth a branch) and to those muscles which occupy the *Fauces* or chops, and into them most part of it is consumed.

The greater Nerue not farre from his egresse sendeth a branch backward, [tab.22.fig. 2.[f]] which is distributed with many surcles into the muscles that occupy the necke, especially into the Cowle muscle which is the second of the shoulder-blade.

His descending trunke.

The Trunke it selfe descending is connected or tyed to the seauenth Coniugation, [tab.22.fig.2.[n]] to the Sleepy artery and to the *internall Iugular* veine, by the interuening or interposition of a membrane, and at the sides of the *Larinx* or Throttle it is increased by a branch from the seauenth Coniugation [tabl.22.fig.2.[i]] with which branch notwithstanding it is not mixed (for *Platerus* in this mixtion mist his marke) but colligated or tyed thereto. Presently after it sendeth surcles ouerthwart [ta.22.fig.2.[g]] vnto the muscles of the *Larinx*, especially those on the inside thereof. It affordeth also a few small branches distinct from the former to the muscles of the *Fauces* or chops. From thence it descendeth

vnto

vnto the Cheſt and runneth quite through his capacity, as alſo thorough the capacitie of the lower belly, and diſtributeth many branches vnto the bowels of both bellies, as wee haue partly declared already and ſhall do heereafter towards the end of this booke. And becauſe it runneth almoſt through all the bowels of the body it is therefore called *Coniugatio vaga*, the gadding or wandering coniugation.

Falopius his conceit of the Oliue-like bodies.

Falopius tels vs, that the Membrane wherewith this ſixt nerue is inueſted, as it falleth through the perforation aſſumeth vnto it ſelfe ſometime manifeſtly, ſometime ſecretly, a few ſmall and capillary fibres of the nerue, and when it is out of the ſcul, produceth a certaine long bodie reſembling an Oliue, which is ſometimes ſingle, ſometimes double in both ſides, and the colour fleſhy, although the ſubſtance be nerious and hard.

This *Oliue-like body* endeth into a certaine neruous fibre, which falling down the neck, together with ſome propagations of nerues coupled together which yſſue from the firſt and ſecond, and fourth and fift and ſixt, or from the firſt and ſecond, and fift and ſixte and ſeuenth paires of the necke, doth make a texture or complication of veſſelles like a little net which deſcendeth on either hand downe the forepart of the whole necke; and in that complication, ſaith he, other new Oliue-like bodies do ſometimes grow togither, whoſe number is vncertaine, conſiſting of no other ſubſtance but as it were a heape of nerues growing together into a callous or faſt body like a ſcarre. And this coniunction of nerues he calleth *ſexti paris plexum*, the texture or complication of the ſixt coniugation; from which texture many nerues, ſaith he, do deſcend vnto the baſis of the heart. Herefrom alſo very often doth a nerue take his originall which on both ſides is conueyed vnto the midriffe, although it receiue a further increment or encreaſe from the fourth and fift coniugations of the necke. Hee affirmeth further, that from this complication there yſſueth a nerue which deſcending through the Cheſt along the rootes of the ribs is conueyed to the roots of the Meſentery. Thus farre *Falopius*.

Why the bowelles haue nerues from this coniugation and not from the ſpinall Marrow.

Now that from this ſixt coniugation, nerues are ſent vnto the bowelles and not from the marrow contained in the rack-bones this reaſon may be giuen, becauſe hauing not voluntary motion they did not ſtand in neede of ſo hard Nerues as doe ariſe out of the ſpinall marrow properly ſo called; yet that they might not be altogether without Senſe, they receiue Nerues of Senſe, that is, ſoft nerues iſſuing out of the marrow of the Braine whilſt it is yet contained in the ſcull, and the rather ſaith *Galen* in the 11 chap. of his ninth Booke *de vſu partium*, becauſe the ſubſtance it ſelfe of the bowels is but ſoft; but becauſe theſe Nerues were to go a long iourney, leaſt they ſhould be offended they are inueſted with ſtrong membranes, and beſides faſtned to the bodies by which they paſſe.

A notable obſeruation.

It is alſo worth the obſeruation that the nerues which are diſſeminated from the ſixt coniugation into the trunke of the bodye, are as large almoſt at their terminations after they haue bene diuerſly diuided and ſubdiuided as they are in their originall, which cannot be ſaide of any other veſſell. It hath bene alſo publickly deliuered, I thinke from no other warrant but ſpeculatiue Learning, that this nerue deſcendeth into the ioynts, and in the feete is the cauſe of the great conſent betwixt the feet and the head. For mine own part, I could neuer haue light of any ſuch diuarications out of Claſſicke Anatomiſts: beſide, what neede we ſearch for an imaginary way of conſent, when we know that which is direct and agreed vpon by all, which is the branches of the nerues of the ſpinal marrow, wonderfully vniting themſelues in the Tendons of the Muſcles of the foote; by which any annoyance may at the firſt hand be conueyed vnto the marrow of the backe and ſo vnto the Braine.

A nouell conceite.

Moreouer, *Galens* reaſon of the allowance of theſe Nerues of the ſixte coniugation to the bowels in the place laſt before quoted were but of ſmall moment if the feet alſo had nerues deriued therefrom. But this onely by the way.

The ſeauenth coniugation.

The ſeauenth Coniugation, which *Archangelus* accounteth for the eight, becauſe he maketh the organs of ſmelling a coniugation of nerues: the ſeauenth coniugation I ſay [Tab. 22. fig. 1 h fig. 2 H] mooueth the tongue and is the hardeſt of all thoſe that yſſue out of the Braine within the ſcull, and indeede it taketh his originall from a harder beginning that is to ſay in the hindpart of the Nowle-bone where the marrow of the Braine endeth ſaith *Galen* in the twelfth of his ninth Booke *de vſu partium*. From the beginning of the ſpinall marrow, ſaith *Veſalius*, but before it yſſue out of the ſcull. From the Braine, not from the After-braine, ſaith *Columbus*. *Archangelus* ſaith from the backpart of the marrow where the cauity is that is compared to a writing pen. From the marrow of the Braine, ſayth

His originall.

saith *Bauhine*, when it is ready to fall out of the scull [Tab. 22. fig. 1 & 2 a] that is to say, at the very beginning of the spinall marrow properly so called. Thence therefore it ariseth with more rootes then one, and those somewhat distant one from another. But they vnite themselues and passe out of the scull by an oblique and proper perforation in the Nowle-bone, and for more security this Coniugation (saith *Galen* in the eleuenth of the ninth *de vsu partium*) is ioyned by strong membranes with the sixt coniugation, but not commixed therewith saith *Falopius* in his Obseruations. For Retribution it communicateth to the sixt paire a portion of it selfe, [Tab. 22. fig. 2 m] that is to say, sometimes one fibre or string and sometimes two, but the coniugation it selfe keepeth stil his owne body, and with a round and full thred runneth downward vnto the tongue, whose roote when it attaineth the greater part thereof [Table. 22. fig. 22] is dissolued or as it were vntwisted and parted into many fibres, which as so many surcles are imparted into all the muscles of the tongue.

His implantation. The lesser part sendeth some braunches vnto the muscles of the bone *Hyois* and the Throttle to assist their motion. It affoordeth also some surcles [Tab. 22, fig. 2 l] vnto the muscles which take their originall from the appendix which is called *Styloides*. Finally, the Fibers of the greater branch doe seeme to be commixed with the Fibres of the fifte Coniugation.

The eight Coniugation. The eight coniugation (if we may so call them, which others do ascribe vnto the fift) [Tab. 22. fig. 1 & 2 d] yssueth out of the marrow of the Braine aboue the Auditory nerue, (and is much slenderer and harder then it) betwixt the second and third coniugations. It runneth vpward and forward vnder the sides of the basis of the Braine, and hauing perforated the *Dura Meninx* betwixt the second and thirde coniugations, it getteth into the orbe of the eye through the hole of the second coniugation, saith *Bauhine*, according to *Falopius*, although *Vesalius* and *Platerus* thinke it passeth through a proper perforation in the wedge-bone, and so goeth vnto the temporall muscle and that which lurketh in the mouth; but the truth is, that it is almost wholy consumed in that muscle of the eie which draweth it to the vtter angle. Implantation

This coniugation, saith *Bauhine*, in regard of his originall should haue bene acounted before the fift and those that follow, but least in changing the number resolued vpon by Anatomists we should breede confusion, wee haue rather thought good to reckon it in the last place. *Columbus* addeth a ninth paire, of which hee challengeth the inuention, and for ought I know no man is desirous to take that prize out of his hande, which when they haue they shall not be able to hold; but he saith that they be very smal nerues arising from the two processes of the Braine which are called *Nates* or the *Buttockes*, neere the Testicles; they bend their course toward the face, and passe out by the third & fourth coniugations and are inserted into the third muscle of the eye-lid, but allow a branch also to the fift muscle of the eye. Thus farre *Columbus*. *Columbus* his 9 Coniugation.

And so much concerning the coniugations of nerues seauen, or eight if you will, or nine if you beleeue *Columbus*, which yssue from the marrow of the Braine contained yet within the Scull. Now we proceede vnto those that yssue from the spinall marrow when it is falne out of the Scull.

CHAP. XXVI. *Of the Nerues which yssue from the spinall Marrow in the Necke.*

THE coniugations before mentioned are called *productions* of the Braine, *and Nerues of the Braine*, albeit they yssue from the lengthened Marrowe thereof, but yet contained within the Scull. Now we come vnto those finewes which draw their originall from the same marrow indeed, but that contained in the rack-bones of the spine, and therefore are called *Nerues of the Spinall marrow*. For from this marrow all the parts which are vnder the face, excepting the bowels and the instruments of the voyce, do receiue Nerues; the bowels and the instruments of the voyce do not, partly becaus it was necessary that some of them shold bee immediately ioyned with the Braine, as the Heart and the Liuer, (for it behooued that all the principles of those faculties whereby the creature is gouerned should be conioyned) partly becaus their situation is neere vnto the Braine, and they stande in neede onely of Sense.

The Nerues of the spinall Marrow are accounted thirty Coniugations yssuing out of distinct

distinct parts and seates, as out of the marrow of the Necke, the Chest, the Loynes, and the Holy bone contained within their *vertebræ* or rack-bones, and issuing out of their perforations or holes thrilled in them. These holes are eyther double before and behind, as in the two first of the neck and fiue of the Holy-bone, or single in each side of the racks, as in the rest.

The coniugations of the necke some account seauen, as *Galen*, *Vesalius*, *Platerus*, and *Laurentius*, yet *Galen* in the fift of the 13 *de vsu partium* reckons 8, and so doth *Archangelus*; *Columbus* but fiue. These are dispersed into the outside of the whole head and his Muscles. 7 of the neck.

The first and second coniugation do not arise after the manner of other Nerues out of the sides of the spondels, one out of the right side, the other out of the left; but one falleth through the hole on the foreside, the other through the hole on the backside, which happeneth because of the different articulation of these two rackes which is so made for the more security of the motion. The first. His diuision.

The first Coniugation issueth betweene the Nowle and the first racke-bone, which that it might more easily be, there is a certaine small cauity in the nowle-bone and in the first *vertebra*, (yet in dogs in whom the spondell is greater, the cauity is onely in it) but before it issue it is reflected aboue the spinall marrow and presently is diuided into two small branches, one *anterior* which is very small, [Tab.23,ᵘ] and so small that *Vesalius* saith it is not alwayes visible, but *Columbus* maketh no mention of it at all.

This nerue is inserted into the muscles which lye vpon the necke and vnder the gullet, which bend the neck, accounted by *Vesalius* and *Platerus* for the first payre that moue the backe, but *Bauhine* reckoneth it for the first bender of the necke, and calleth it *Longus* or the *Long-muscle*. Subdiuision.

Table 23 is the same with Table 22. Lib. 7. folio 490.

The other *posterior* [Tab.24,ᵗ] which is subdiuided into a double surcle, one lesser which are disseminated into the smal muscles of the head seated in the *Occipitiũ* or nowle, the right branch into the muscles on the right side, and the left into the muscles of the left side, which also we must vnderstand of the nerues that follow. The other surcle of the posterior branch [Tab.24,ᵒ] goeth into the beginning of the muscle that draweth the shoulder-blade vpward, for being but small they do not run beyond the muscles.

The second coniugation issueth with two beginnings, the fore branch [Tab.23,ᵛ] is very small and slippeth out betwixt the first and the second rack-bone at the sides of the tooth, and is distributed into the muscles that sit vppon the neck, as that branch of the first coniugation is, of which we spake ere while, with which branch it is implicated, and so consumed into the whole skin almost of the face. The second coniugation. His double originall.

The posterior branch which is the greater [tab.24,l] when it is issued by the side of the backward processe of the second rack-bone is presently diuided into two vnequal brãches: the thicker [Ta.24,ˣ] runneth ouerthwart toward the middle of the spine where the muscles do meete that occupy the necke, and is increased with a surcle [tab.24,ᴸ] of the third coniugation, [tab.23,ˢ] and from the back-part tendeth vpwarde vnto the fore-part of the head, and disperseth propagations into the skinne of the whole head euen to the top of the whole crowne, yea and vnto the eares; [tab.23, and 24,ᵡᵡ] but the lesser branch [ta. 24, aboueˣ] is distributed into the beginnings of the third and sixt payres of muscles of the Head.

The third coniugation [Tab.23, char.3.] breaketh out of a common hole which is betwixt the second and third spondell, and is diuided into two branches. The anterior whereof [Tab.23,ˣ] is subdiuided into foure surcles, the first goeth to the first paire of muscles that bend the necke, the second [tab.23, and 24,ˣ groweth with ʸ] runneth downward, and being commixed with a surcle of the fourth coniugation is distributed into the muscles that lye vnder the Gullet. The third coniugation. His diuision.

The third surcle [tab.23,ˢ tab.24, from ˣ to ᴸ] runneth vpward and meeteth with a branch of the second coniugation, and is spent into the skin on the sides and top of the head. The fourth [tab.23, and 24,ᵀ] is dispersed into the muscles that incline the neck to the sides, as also vnto the muscle that lifteth vp the blade. and subdiuisiõ

Finally, into that quadrangular muscle arising from the fleshy Membrane which draweth the lip obliquely downeward. The posterior branch of the third coniugation [ta. 23, 24, ᵒ] is disseminated into the muscles that are common to the head and the necke,

and

and lift it vp which are called *Sacer* and *ſemiſpinalis*. The firſt *Veſalius* accounteth for the ſeauenth mouer of the backe, and the ſecond for the eight.

The 4 coniugation.

The fourth Coniugation [ta.23.char.4.] yſſueth out of the common hole of the third and 4. Rack-bones, and is diuided ſayth *Columbus* into many ſurcles. *Bauhine* ſayth into 2. branches, an *anterior* & a *poſterior*: the *anterior* which is the greater, is deuided into three propagations. [ta.23.& 24.x.]

Diuiſion.

The firſt [ta.23.y] is mixed with a branch of the third payre [ta.23.z] and goeth to the muſcles that lye vnder the Gullet, which make the firſt payre of Benders of the Necke.

The ſecond [ta.23.a] departeth into the muſcles that bend the neck into the ſides, that is, into the ſecond payre and to the ſecond muſcle of the ſhoulder-blade called *Cucullaris* or the Cowle muſcle.

The third [ta.23.b] which is leſſer, being accompanyed with a branch of the fift Coniugation, [ta.23.c] and vnited with a propagation of the ſixt [table.23.m] deſcendeth neare the *Mediaſtinum* (where it letteth ſlip a ſmall branch on each ſide) and aboue the *Pericardium*, that of theſe originalles, that is to ſay, the fourth mixed with the fift and the ſixt, the nerue of the Midriffe [ta.23.& 24.n] might be compounded which is inſerted into his neruous tendon called by others his Head. Sometime this branch of the fourth Coniugation is wanting, and then a ſurcle of the ſeauenth Coniugation ſupplyeth the place, but howſoeuer the chiefe part or mountenance of the Nerue is from the fift Coniugation. The *poſterior* branch of the fourth Coniugation which is alſo the leſſe [tab.23.and 24.o] at the ſpine of the third Racke-bone beſtoweth his bleſsing vpon the muſcles of the neck, which lye vpon that ſpondell, and from thence is conſumed into the membranous muſcle of the cheekes.

The 5 Coniugation. his diuiſion.

The fift Coniugation [ta.23.char.3.] falling out vnder the fourth ſpondell, is deuided into two branches, one *anterior* another *poſterior*. The firſt ſurcle [ta.23. a d vnto char.6.] of the *anterior* branch [ta.23,and 24.d] goeth to the muſcles which bend the necke. The ſecond [ta.23.e] together with the propagations of the fourth and the ſixt Coniugations [ta,23,out of b e m] maketh the nerue of the Midriffe. The third [t.23,and 24,f] runneth vnto the muſcle called *Deltois* which is the ſecond of the arme, from which final branches [ta.24.g] are afforded to the muſcles that lift vp the ſhoulder-blade called *Cucullaris* and *Leuator*.

From the ſame ſurcles alſo ariſeth another Nerue [tab.23.and 24.h] which with many ſmall fibres is implicated in the skinne that couereth the *Deltois*; another lying deepe at the necke of the ſhoulder-blade is deuided into two branches, the *anterior* [ta.23.& 24.i] and the ſmaller affoordeth ſmall ſurcles to the *Deltois*, where it taketh his originall from the clauicle, ſometimes alſo to the skinne, accompanying the *humerarie* veine.

Table 24. is the ſame with Tab.23. Lib.7. Folio 490.

The *poſterior* which is the thicker [table.23.24.k] firſt ſendeth a ſurcle into the ſecond payre of muſcles of the bone *Hyois* called *Coracohyoidei*: afterward being accompanied with a veine and an artery, it ſendeth another to the vpper *ſuperſcapular* muſcle or the vpper Blade-rider, againe vnto the *Deltois* where it ariſeth from the ſpine of the blade, and finally it ſendeth ſurcles [ta.23.24.l] to the outſide of the skin of the arme: and ſo much of the *anterior* branch of the fift Coniugation. The *poſterior* [ta.24.c] at the tops of the ſpines is reflected and diſtributed like the *poſterior* branch of the fourth Coniugation.

The ſixt coniugation.

The ſixt Coniugation which *Columbus* calleth the firſt paire of ſinewes of the hand [ta.23.char.6.] vnder the fift ſpondell where it yſſueth is deuided into an *anterior* and *poſterior* branch.

The *anterior* [ta,23,l] after it hath ioyned a propagation [tab.23,m] to the branch of the fift Coniugation to make the nerue of the Midriffe, is vnited with the ſeauenth of the necke, and the firſt Coniugation of the Cheſt. [ta,23,and 24,q] Afterward it is diuerſly deuided, and with thoſe that follow furniſheth out nerues to be tranſported to the Arm. It ſendeth alſo a peculiar ſurcle [ta,24,p] vnto the hollow part of the ſhoulder-blade into the muſcles that lift it vp.

The *poſterior* branch [ta,24,k] is diſperſed after the manner of the reſt vnto the muſcles which moue the head and the neck, as alſo into the heads of the muſcles which ſerue for Reſpiration, which from the necke doe attaine vnto the Cheſt whoſe muſcles alſo receiue nerues from the ſeauenth Coniugation and from the firſt of the cheſt.

The

The ſeauenth Coniugation [Tab,23,chara,7,]yſſueth vnder the ſixt ſpondell of the necke,and for more ſecurity is ioyned with the ſixt coniugatio 1 of the necke and the firſt of the cheſt,[ta,23,r] the chiefe part whereof runneth into the arme, for the nerues of the arme are produced from the fift, ſixt and ſeauenth coniugations of the necke, and from the firſt and ſecond of the cheſt. The ſeauenth coniugarion. His diuiſion.

Somtime alſo there proceedeth from this coniugation a branch to the making of the nerue of the midriſſe. Wherefore ſeeing that from the marrow of the necke many nerues do concur to the making of the midriffe-nerue, it is no wonder that in the Apoplexy the motion of the midriffe is for a while naturall, for although becauſe of the obſtruction of the ventricles of the braine, as it is commonly beleeued,the animall ſpirit cannot bee conuayed vnto the midriffe, yet ſeeing that the cauity of the ſpinall marrow containeth ſome deale of animall ſpirits, which by theſe nerues may be tranſported vnto the midriffe, and giue it a little motion,thence Reſpiration remaineth,& though it be but very little,yet the life is thereby ſuſtained as long as the animall ſpirit ſhal remaine in the cauity of the ſpinal marrow, and if the obſtruction of the ventricles can be freed, then he that is apopleticall, returneth to himſelfe, if not there he determines his life. How a man breaths in an Apoplexy.

This is *Bauhines* phyſicke concerning the apoplexy and the cauſe therof,wherto though I can in no ſort agree, yet becauſe he handleth it but by the way, and we are now in another argument I will not reaſon the caſe with him.

The poſterior branch of the ſeauenth coniugation [tab.24,r] which is alſo the leſſe & neuer miſsing,affordeth ſurcles to the muſcles which lye vpon the neck & vnto the *ſquare muſcles* of the cheekes; into which alſo ſurcles are ſent from the fift coniugation of the braine,and from all ſeauen of the necke excepting onely the firſt, which ſurcles runne according to the courſe of the fibres of the muſcle: they attaine alſo vnto the skinne. It is no wonder therefore if the *Dog-ſpaſme* be a greeuous diſeaſe, ſeeing that this muſcle in it doth at the firſt hand ſuffer conuulſion. The *dog ſpaſme*

Galen in the fift chap.of his 13 book *de vſu partium*, and after him *Archangelus* do adde an eight coniugation iſſuing betwixt the ſeauenth and the eight ſpondell and diſtributed eſpecially into the Cubit and the Ell but paſſeth no further. The 8 coniugation after *Galen* & *Veſal.*

CHAP.XXVII. *Of the Nerues of the Cheſt.*

THE nerues diſſeminated through the cheſt are double as well as thoſe that paſſe through the necke, for ſome take their originall from the braine, or rather from the marrow thereof contained in the Scull, others from his marrow paſsing through the rack-bones of the backe. Of the nerues of the cheſt.

From the marrow of the braine proceedeth the ſixt coniugation of the braine which runneth through the cheſt, of which we haue partly ſpoken before, but will ſay more afterward in this booke.

From the ſpinall marrow contained in the rackes of the backe do iſſue eleuen coniugations ſaith *Veſalius*, but *Bauhine* reckoneth twelue, all which after their egreſſe are diuided into two branches,one greater and another leſſe, one running forward and another reflected backward. Twelue coniugations.

The firſt coniugation [Tab.23, char.8.] which *Veſalius* accounteth the eight of the ſpinall marrow,iſſueth betwixt the ſeauenth rack-bone of the neck and the firſt of the cheſt on eyther ſide and is diuided into two branches,one anterior and another poſterior. The firſt coniugation. His diuiſion.

The anterior which is the greater,after it hath receiued an augmentation[Ta.23,& 24.x] from the ſeauenth coniugation,ſomtime alſo from the ſecond of the cheſt,& is diuerſly commixed with the neighbour ſinewes;attaining vnto the arme-pits,diſtributeth propagations [tab.24,aa] out of his back-ſide into the hollow part of the blade, and ſo runneth away into the arme whoſe diſtribution we ſhall meete withall in that place.

Beſides this, it ſendeth alſo another branch [tab.23,y] vnto the arme, which running forward along the firſt ribbe, and ſo to the top of the breſt bone beſtoweth his bleſsing vppon the firſt muſcle of the cheſt called *Subclauius*, and then is conſumed or ſpent into the muſcles which take their originall from the toppe of the breſt-bone,as the muſcle called *Maſtoides Sternohyoidei* and *Oeſophagei*.

The *poſterior* branch[ta,24,u]which is the leſſer,is reflected vnder the muſcles which grow vnto the Rack-bones,and in his tranſition affordeth ſmall ſhoots to the ſecond muſcle of the necke and thoſe that moue the necke and the head backeward; but when it hath attained

attayned the ſpine of the ſeauenth Racke-bone it departeth therefrom and offers ſurcles ouerthwart to the lower part of the Cowl-muſcle, the *Rhomboides* and the vpper & backward ſpine.

The 2. coniugation.

The ſecond Coniugation [tab,24,char,9,]yſſueth betwixt the firſt and ſecond rack of the Cheſt, and as the former it tranſmitteth and diſtributeth a branch backeward [tab 24.β.] Afterward a good part is ioyned with a branch of the firſt coniugation [tab,24.α] and runneth into the arme. The remaynder proceedeth according to the length of the firſt rib vnto the Cheſt and maketh the *Intercoſtall* nerue, from which certaine ſmall ſurcles are diſtributed vnto the muſcles that lye vpon the Cheſt.

The 3. and the nine following.

The third and the other nine Coniugations [tab,23,from char,10.to char.20,]of the cheſt are diſtributed after the ſame manner, for after they are iſſued out of the ſides of the Rack-bones, they are deuided into two branches. The *anterior* branches which are called the *Intercoſtall* ſinewes [tab,23,ππ] in their paſſage doe offer a ſurcle to the *Coſtall* nerue, which is ſayde to be a branch of the ſixt coniugation of the braine, and runneth vnder the *Pleura* vnto the rootes of the ribs: yea throughout his whole iourney they increaſe it with a ſmall branch. For the branches themſelues runne directly after the bent of the ribbes through the diſtances betwixt them in a proper *ſinus* or cauity inſculped or grauen in the inner and lower ſide of euery rib for the tranſportation of theſe branches, together with a branch of the veine *Azygos* and the great artery which accompany them; and their courſe is forward vnder the *Pleura* neare the *Intercoſtall* muſcles: ſo that the *Intercoſtall* veines of the true ribbes do reach as farre as to the breaſt-bone, thoſe of the baſtard ribbs do attain vnto the foreſide of the *abdomen* aboue the *Peritoneum*.

Their fore branches.

From theſe, diuers branches [ta,23,θθθ and the characters of the left ſide] are diſſeminated into the *Intercoſtall* muſcles as well internall as externall, into the muſcles that lye vpon the cheſt, [tab,23,θθ ιι κκ] as the greater and leſſer Saw, the *Pectorall* muſcle and that which is called *Latiſſimus*, [tab,23,μμ] moreouer into the oblique deſcendent muſcle of the *Abdomen*; all which branches immitate the fibres of theſe muſcles. They offer alſo ſmall ſhootes ſprinklingly vnto the skin of the cheſt.

Theſe Nerues as alſo the reſt, of courſe ſhould haue beene inſerted directly into the heades of the muſcles, but nature hath reflected them backeward into the veines, arteries and ligaments of that place. From the lower *Intercoſtall* nerues, ſome ſhootes alſo are communicated [tab,23, λλ] to the muſcles of the *abdomen*.

Finally, from that *Intercoſtal* Nerue which creepeth through the fourth diſtance of the ribs are certain propagations [ta.23,ν] diſſeminated into the *Pectoral* muſcles, from which there yſſue ſome fine and ſmal ſhootes vnto the paps and giuing them a very exact ſenſe. And ſo much for the *anterior* branches.

Their hinder branches.

The *poſterior* which are the leſſer are reflected backward vnto the ſpines of the rack-bones, and lurke amongſt the muſcles that grow vnto them, and are appoynted to moue the Backe and the Cheſt: yet are they not wholly conſumed in theſe muſcles; for when they haue touched the tops of the ſpines, they fall betweene the congreſſe or coniunction of the muſcles of both ſides, and are diſtributed into the muſcles which ariſe from thoſe heights of the Spines, as thoſe that are called *Splenij*, *Rhombeides*, *Cucullaris*, *Latiſſimus*, *Serratus*, *Poſticus inferior*; and ſome are diſtributed into the skinne. But the diſtribution of Nerues into the skinne is not one and the ſame in all bodies, and therefore can neither their order nor their number be certainly defined, for the trunkes are deuided throughout the skin, ſometime into more ſometime into fewer branches.

To conclude, the two laſt coniugations of the cheſt doe offer ſurcles, *Columbus* ſayth to the fleſhy part of the Midriffe: *Bauhine* [ta,23, at the ſides char.18,19] to the head of the muſcle called *Lumbalis* or the ſixt muſcle of the Thigh.

CHAP. XXVIII. *Of the Nerues of the Loines.*

The nerues of the loynes.

THE common & receiued opinion is, that frō the ſpinal marrow contained in rack-bones of the Loines doe ariſe fiue Coniugations of ſinnewes which are greater then the coniugations of the cheſt and yſſue out of the holes of the rackes of the Loines; heerein agreeing with the nerues of the cheſt, that euerie coniugation is diuided into an *anterior* and a *poſterior* branch, and that from the *poſterior* branches [Tab.24. char.52,53] propagations are diſtributed into the muſcles that grow vnto the rackes of the Loines. Among themſelues they haue this alſo common ſaith *Galen*, that they are diſſeminated into the ſpinall muſcles, the *Abdomen* and the fleſh of the Loines.

5. coniugatiōs

The

The first coniugation [Tab.23.char.20] as also the rest issuing at the hole of the spondell vnder the Rim is diuided into two branches, one *anterior* and greater, from vvhich surcles are sent into the fleshy parts of the Midriffe, others vnto the head of the Muscle called *Lumbalis*, others vnto the muscles of the *Abdomen*. The *posterior* braunch is the lesser and reflected into the muscles which lye vpon the rackes of the Loines whereinto it is consumed as are the Surcles of the following coniugations. Such are the muscles called *Sacrolumbus*, *Longissimus* and *Sacer*. But where they yssue from the tops of the spines they run into the sides and are disseminated into the skin of the arme and the broade Muscle called *Latissimus*. The first coniugation.

The second coniugation [tab.23.char.21] runneth vnder the sixt muscle of the thigh called *Lumbalis* vpon which it bestoweth small branches afterward: arising vppe vnto the top of the hanchbone the *posterior* propagation therof passing the *Abdomen* doth afford Sense and Motion to the first muscles of the thigh which make the buttockes, and to the first extender of the Legge called *Membranosus*. But the *anterior* branch is distributed into the seuenth muscle of the thigh according to *Vesalius* and *Falopius*, but the sixt according to *Bauhine* and *Columbus* called *Iliacus internus*; into the first bender of the legge and vnto the skin of the thigh. From this coniugation also yssueth a small and long Nerue, [Tab 23.char.49] which together with the spermaticall vesselles of his owne side is conuayed vnto the Testicle, whicht Testicles also receiue surcles frō the *Costal* or rib-branch of the sixt coniugation of the Braine. The second.

The third coniugation [tab.23.char.22] yssueth also vnder the *Lumbal* Muscle. His *anterior* braunch passeth neere the haunch-bone and is diuided into two propagations; One of which goeth vnto the knee and the skin thereof, the other accompanieth the vein called *Saphena*. But the *posterior* branch is reflected and disseminated into the Muscles that lie vpon the Loines and into the skin. In like manner from the *anterior* branches of the three first coniugations certaine surcles [tab.23 at the sides, charact.20,21,22] apply themselues vnto the costall nerue and are ioyned therewith. The third.

The fourth coniugation [Tab.23.char.23] which is the greatest of all the paires of the Loines, runneth vnder the *Lumbal*-muscle and the share-bone accompanying the vein and artery vnto the groine. *Columbus* obserueth, that it sendeth some propagations into the cod and the skin of the yard: but we, saith *Bauhine*, haue obserued that those partes do receiue final sinewes from the marrow of the holy-bone as *Galen* noted in his seuenteenth Booke *de dissectione Musculorum*, and after him *Archangelus*. It distributeth also other propagations, *Columbus* reckoneth seauen, vnto the *anterior* muscles of the thigh and the legge, from which some surcles do descend as farre as to the knee.

The fift coniugation [tab.23.char.24] like the rest is diuided into two. The *anterior* and greater branch passeth through a hole betwixt the bone of the *Coxendix*, of the share and of the hanches, and distributeth propagations sometimes to both the muscles that compasse or bend the Thigh about; sometimes vnto the seuenth and eight benders of the Thigh, sometimes vnto the muscles of the yard, though commonly they receiue nerues from the marrow of the Holy-bone. Item, branches vnto the neck of the bladder & of the wombe which also receyued nerues from the marrow of the Holy-bone. But the *posterior* branch is reflected and consumed into the muscles that sit vpon the rackes of the Loines and into the skin of that place. Finally, from the three lower coniugations no smal number of branches do reach vnto the Leg, as in that place wee shall not forget to remember.

Moreouer, these coniugations are hard and fastned one with another, the first with the second, the second with the third, the third with the fourth, the fourth with the fift, as it is demonstrated in the first figure of the 23 Table; after the same manner altogether as the Nerues of the arme are implicated one within another. The connexion of these coniugations.

CHAP. XXIX. *Of the nerues of the Holy-bone.*

OVt of the marrow concluded within the rackes of the Holy-bone doe yssue sixe coniugations of Nerues. *Galen* reckoneth three of the Holy-bone, and three of the rumpe-bone. But *Vesalius* and *Columbus* do heerein reproue *Galen*, with what euidence of truth I cannot say, it appeareth manifestly that he was not ignorant of these bones euen in the bodies of men. Sixe coniugations of the Holy-bone.

The first Coniugation [Tab.23.char.25] yssueth betwixt the last racke-bone of the loynes The first.

loynes and the first of the Holy-bone after the same manner as it was in the coniugations of the loynes, and is diuided into an *anterior* and a *posterior* branch. The Anterior branch, although the greatest part thereof be mixed with the Nerues which are conueyed vnto the legge, yet notwithstanding it sendeth a propagation [Table.23. char.53] vnto the inside of the hanch-bones from whence surcles are offered to the Muscles of the *Abdomen* and the seuenth muscle of the thigh which is called *Iliacus internus*. The posterior branch runneth after the same manner as do the other Coniugations, and shooteth a propagation [Tab.24.char.54] into the muscles produced from the haunch-bone, especially into the first moouer of the Thigh from whence issue surcles consumed into the skin of the buttockes.

The fiue last. The fiue subsequent Coniugations [Tab. 23. from char.26 to 30] are produced after one and the same manner: for before their egresse they are on both sides double and on either side one Nerue falleth forward, and on either side one Nerue backward. The three vpper Anteriors or forward nerues, as also that of the first coniugation, doe run vnto the legge: the two lower vnto the muscles of the fundament and the bladder, haply also to the priuie parts, in some bodyes vnto the Necke of the Wombe, of the bladder, and of the yard. Finally, others are conueyed vnto the *Perinæum*, that is, the place betwixte the Cods and the Fundament, and vnto the cods themselues.

Their anteriour branches.

Their posteriour branches. The Posterior branches [Tab.24. char. 54, 55] are distributed into the muscles which take vp the *posterior* part of the hanch and holy bones; into the muscle of the backe called *Longissimus*; into that which is called *Sacer* or the holy Muscle; into the Membranous beginning of the broad muscle of the Arme and the sixt of the Chest called *Sacrolumbus*: finally into the foure extenders of the thigh, and into the skin of the buttockes.

But the termination or end of the spinall Marrow [Tab.23 and 24.ch. 56] yssuing out of the Holy-bone doth on either side part with a propagation which sometimes is distributed into many surcles on the right hand and on the left, which is disseminated through the fourth muscle of the thigh through the skin which is betwixt the buttockes euen vnto the fundament: yet some say that it is distributed as other nerues are, and call it *Neruum sine coniuge* the Nerue without a companion: and thus it is in man. But in Apes & Dogs there are three Coniugations of which the two lower onely are produced forwarde and backward; the rest of the Coniugations yssue out at the sides of the rumpe bone, as they do out of the rackbones of the Chest and of the Loynes.

The sum of al From this History of the Nerues of the spinall marrow we conclude that it hath thirty coniugations or paires of Nerues, seauen of the marrow of the necke, twelue of the marrow of the backe or of the Chest, fiue of the marrow of the Loynes, six of the marrow of the Holy-bone. And all these with their seuerall originals, places of egresse and distributions, not onely Physitians but Surgeons also ought necessarily to knowe that they may be able to apply their Vnguents and Cataplasmes vnto the right places of the spine or ridge when either the Nowle, or the face, or the necke, or the hands, or the partes of the chest, or the muscles of the *Abdomen*, or the wombe, or bladder, or the fundament, or the yard, or the legs shall be depriued of motion or sense, or both together. Thus much concerning the nerues of the spinall marrow, and the parts thereof.

How necessary the knowledge of this is for Chirurgeons.

CHAP. XXX. *Of the Nerues of the Hand in the large acception.*

The Hand, THE Hand is the Instrument of Instruments, that is to say, the Instrument of the minde or Soule whereby she frameth and fashioneth all Instruments which consist of any matter whatsoeuer, or haue respect vnto any commodity or profit of man. And therfore that it might more freely do the seruice it was ordayned for; it hath in allowance not only muscles the instruments of voluntary motion, and veines which conuay bloud and nourishment vnto it, and arteries to giue it vigour and viuacity: but also it hath nerues as wel to conuay the motiue vertue vnto the muscles, as also to furnish it with the most exact sense of touching. There are therefore disposed vnto the Hand sometimes fiue payres of sinnewes, sometimes sixe, arising from the spinall Marrow contained in the racke-bones of the Necke and Chest, that is to say out of the fift, sixt and seuenth of the Necke, and the first and second rackes of the chest. These Nerues do yssue out of the common perforations of the aforesaid rackbones, and presently after their egresse are vnited at the sides of the spondils: afterward, they are separated, againeconioyned, and finally separated, so seeming to make the meish

Hath 5 paire of sinewes.

of

of a net,[tab.25,fig.3,] or ſaith *Columbus* and that out of *Veſalius*, it is like the ſtrings of a Cardinals hatte. This implication was made for more ſecurity that the nerues which were to walke a longer iourney might become harder,and ſo ſtronger to propulſe or endure any iniury that might be offered vnto them.

Theſe nerues run vnder the clauicle or cannell bone vnto the inner proceſſe of the ſhoulder-blade, where the Baſilica veyne and the Axillary artery keepe their way, and hence it is that wounds in this place are ſo very dangerous, and luxations of the ſhoulder do eaſily bring a conſumption vppon the Patient. Why wounds about the clauicles are dangerous, and the luxation of the ſhoulder.

From this fore-ſaide implication or complication of the ſinewes do the nerues of the hand or of the arme ariſe,and creepe betwixt the skinne and the fleſhy membrane deeply drenched in fatte in the bodies of men, and by their mediation that fleſhy membrane is indiſſoluebly faſtened to the skinne,but they do not alwayes retaine the ſame magnitude, poſition and number;alwayes they are diſtributed into many backward branches, but the greater nerues Nature hath worthily diſtributed into the inſides of the hand becauſe by them it performeth all his actions.

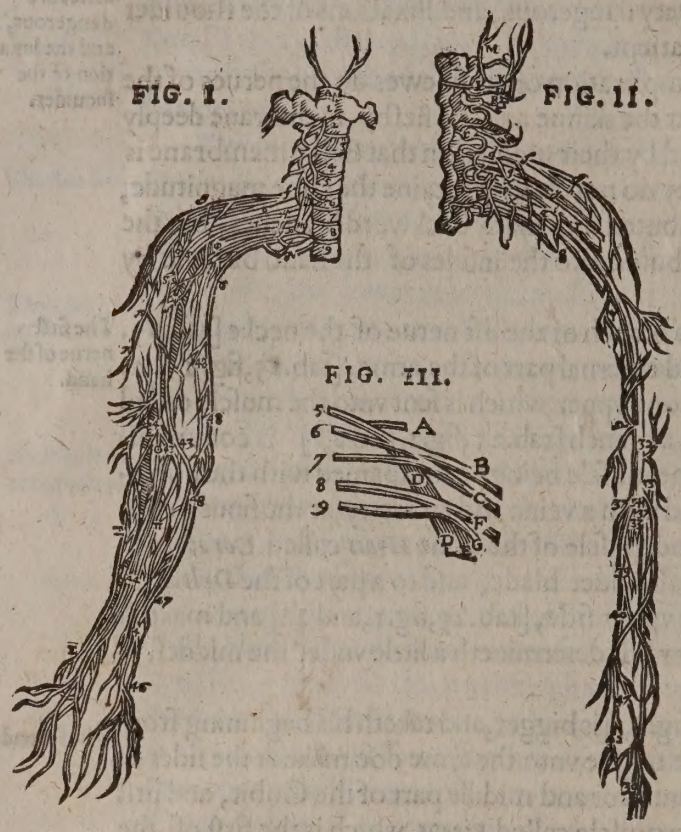
The firſt nerue of the hand is a ſurcle of a branch of the fift nerue of the necke [tab.25. fig.1,]which runneth through the vpper and external part of the arme, [tab.25,fig.1 & 2. f] and is diuided into two branches. The one vpper,which is ſent vnto the muſcle called *Deltois*, [Tab.25,fig.1,and 2,h] from which a branch [tab.25,fig.1,and 2,s] is communicated to the skinne that lyeth vppon the ſame muſcle being accompanied with the humerary veyne. The other being accompanied with a veine and an artery,at the ſinus or boſome of the blade paſſeth on vnto the ſecond muſcle of the bone *Hyois* called *Coracohyoideus* which occupieth the vpper part of the ſhoulder-blade, and to a part of the *Deltois* & the skinne of the middle of the arme on the vpper ſide, [tab.25,fig.1,and 2.i] and maketh the firſt nerue of the arme. [tab. 25,fig.1,ϖϖ] It determineth a little vnder the middeſt of the length of the arme. The firſt nerue of the hand.

The ſecond nerue of the hand [Tab.25,fig.1,ℓ] is bigger,and taketh his beginning from the complication which the nerues that are to goe vnto the arme doe make at the ſides of the rackbones. Thence it falleth by the anterior and middle part of the Cubit, and firſt of all communicateth a ſmall branch to the muſcle called *Biceps* which is the firſt of the Cubit :[tab.25,fig.1,ss] afterward it ioyneth with the the third nerue, [Tab.25,fig.1,& 2. τ] and after the coniunction it creepeth downeward, [Tab.25,fig.1,ω] and from the outſide ſendeth a ſmall branch [ta. 25,fig. 1,Γ] to the muſcle of the Wand called *Supinator longior*. But when it hath attianed vnto the bent of the cubit it is diuided into three branches,(ſomtimes into two,but then the lower is againe ſubdiuided)one vpper and ſmaller, [ta.25,fig.1, creeping from the vpper ε vnto the lower ε] which paſsing a good way by the outſide of the arme with a branch of the humerall veine runneth vnto the outſide ſometime of the firſt,ſomtime of the ſecond ioynt of the thumb, and intertexeth that part with ſmall ſurcles. The ſecond [tab.25,fig,1,ϴ] is the middle-moſt and ſomething larger then the former. It lyeth vnder the foreſaide humerall veyne where the Median or Common veyne ariſeth thereout(and deſcendeth with an oblique paſſge along the cubit,but aboue the fleſhy pannicle)euen vnto the wreſt. [ta.25,fig-1,Λ aboue 44] The third is the loweſt. [ta.25,fig.1,ξ] His progreſſe is ſomwhat oblique and is faſtened to the interior branch of the Baſilica veyne,& in the cubit is diuided into two branches, [ta. 25,fig.1,Π Σ] at length ouercomming the wreſt it diſtributeth ſurcles to the skinne on the inſide of the hand, frō which ſomtimes ſmal ſhootes do attaine vnto the outſide of the thumbe, which are commixed with th ſurcles of the poſterior branch. The ſecond. His diuiſion into three branches.

The third nerue of the hand [ta.25,fi.2,τ] runneth through the fore and lower ſide of the cubit and vnder the *double-headed* muſcle in the arme is increaſed with a brauch of the ſecond nerue.[ta.25,fig.1,Ψ] Preſently after it is diuided and affoordeth two branches to the skin on the forepart of the arme [ta.25,fi.1 υ betwixt τ and χ.] When it hath attained vnto the bent of the cubit,it is mingled with the fift payre,[ta.25,fig.1,ch.43,] & ſendeth ſmall branches vnto the muſcles which grow out of the inner protuberation of the arme : from hence it reacheth a notable branch obliquely to the *Radius* or wand,[ta.25,fig.1.ch. 44,]which being accompanied with a veine & an artery is parted into 3.and runneth into the inſide of the hand,communicating 2 ſurcles to the thumbe, two to the fore-finger,& one to the vpper ſide of the middle finger. And when this middle finger doth not receiue a ſurcle from the fift nerue, then it alloweth two to the middle and ſomtimes one to the Ring-finger. The third.

Table 25. Fig. 1 & 2 ſheweth the Nerues of the whole hand, the firſt figure ſheweth their foreſide, the ſecond their backſide.

TABVLA XXV.



A, the ſpinal marrow getting into the Rack-bones.
charact. 1,2,3,4,5,6,7,8,9. Seauen rackbones of the necke and two of the Cheſt.
c 2 the hinder branch of the fiſt paire.
d 1.2, the forward branch of the fiſt payre.
f 1,2, A branch of the nerue *d* creeping to the top of the ſhoulder, vnder which are ſurcles going to the ſhoulder-blade.
g 1,2, Propagations of the nerue *f* going to the skin of the top of the ſhoulder.
h 1,2, A branch of the nerue *f* going vnto the ſecond muſcle of the arme.
i 1,2, Another branch inſerted into the ſame and to the skinne.
charact. 6, in 1, the fixt coniugation of ſinewes
k 2, the hinder branch of the ſixt paire.
l 1, the fore branch of the ſixt payre.
m 1, A ſurcle thereof that maketh the nerue the midriffe.
p 2, A branch of the fixt payre reaching vnto the cauity of the ſhoulder-blade.
q 1,2, the complication of the branch *l* with the neighbour branches.
char. 7, in the firſt fig. The ſeauenth paire of nerues.
r 2, The hinder branch of the ſeauenth payre.
ſ 1, the congreſsiō or meeting of the ſeuenth payre with his neighbour branches.
t t t, Some ſurcles hereof going vnto the muſcles of the ſhoulder-blade and the arme.
u 2, the hinder branch of the eight payre.
x 1 2, the coition or meeting of the 8 payre with the ſeauenth.
y 1, A branch of the eight payre going to the top of the breſt, *αα* 2, Surcles from the eight payre going vnto the muſcles of this place. char. 9, in the firſt figure, the ninth payre of nerues. *β* 2, the hinder branch of the ninth payre. *δ* 1, the fore branch of this coniugation. *ϖϖ* 1, the firſt nerue of the arme going vnto the skin. *ρ* 1, 1, the ſecond nerue of the arme. *ſſ* 1, Frō this do proceede nerues going vnto the firſt muſcle of the Cubit called *Biceps*. *τ* 1 2, the third nerue of the arme *υ* 1, A branch thereof to the skin of the arme. *φ* 1, A ſmall branch going vnto the ſecond muſcle of the Cubit called *Brachiæus*. *χ* 1, to the skinne of the foreſide of the arme. *ψ* 1, the meeting of the third nerue with the ſecond. *ω* 1, the ſecond nerue together with the third creeping downeward. Γ 1, A nerue to the ſecond muſcle of the *Radius* called *Supinator longior*. Δ 1, the diuiſion of the ſecond nerue into three branches. EE 1, the vpper or firſt branch of the ſecond nerue running vnto the wriſt and ſo vnto the firſt ioynt of the thumbe. Θ, the middle branch of the ſecond nerue. Λ 1, His progreſſe euen vnto the hand. Ξ 1, the lower and third branch of the ſecond nerue. Π Σ 1. two branches of this nerue going vnto the inſide of the hand. Φ 1,2. The fourth nerue of the arme. Ψ 2, Nerues from this vnto the extending muſcles of the Cubit. Ω, A branch vnto the skinne on the backſide of the arme. 32, 2, to the skinne on the outſide of the arme. 33, 2, A branch creeping along the outſide of the Cubit vnto the wreſt. 34, 2, the bypartition of the fourth nerue at the cubit. 35, 2, the vpper branch of the ſaide diuiſion. 36, 2, the ſurcles which belong to the thumbe, the forefinger, and the middle finger on their outſide. 37, 2, the lower branch of the foreſaide diuiſion. 38, 2, Surcles therefrom vnto the muſcles ariſing from the externall protuberation of the arme. 39, 40, 41, 2. three branches going to the muſcles that ariſe from the *Vlna* or *Ell*. 42, 2, the end of the branch 37 neare the ioynt of the wreſt. * 1, 2, the fift nerue of the arme. 43, 1, Propagations of the third and fift nerues, vnto the inſide of the Cubit. 44, 1, A branch of the third nerue going vnto the palme of the hand and the fingers. 45, 1 A branch of the fift nerue vnto the inſide of the hand. 46, 1, A propagation of the branch 45 vnto the outſide of the hand. 8, 1, 2 The ſixt nerue of the arme. 47, 1, His end neare vnto the ioynt of the hand. 48, 48 1, Surcles from the ſixt nerue vnto the skinne.

Fig. 3. Sheweth the complication of the Nerues which come vnto the arme out of Veſalius.

Char. 5, 6, 7, 8, 9, The rootes of thoſe coniugations from which nerues are produced vnto the arme. A A portion of the fiſt payre or the firſt nerue. B, the ſecond nerue. C, the third nerue. DD, the fourth nerue which iſſueth out of the backſide of the congreſſe or coniunction of the fiſt payre and the fixt, it aſſumeth a portion out of the backſide of the coniunction of the ſeauenth payre, and after creeping vnder the coniunction of the eight and ninth payres, it alſo aſſumeth a portion therefrom. E, Which is the branch marked with E. F, the fiſt nerue that runneth into the arme. G, the fixt nerue deriued into the arme.

The

The fourth Nerue [tab.25.figu.1,and 2,Φ]which is the largeſt of all the Nerues that runne into the Arme,taketh his beginning from the complication we ſpake of before. It runneth along the backeward and vpper part of the cubit ouer the externall protuberation of the arme,and paſsing along with the *Deepe-veine* and the Axillary artery,it inflecteth it ſelfe at the vtter and backepart of the arme, and diſtributeth two branches to the extending muſcles of the cubit[ta.29.fig.2.Ψ]and to the skinne which is at the ioynt, and vnto the backepart,and another vnto the vtter part. [ta,25,fig,2,Ω and char,32,] Afterward neare the ioynt of the cubit at the externall protuberation of the arme [tab,25,fig2, char,34,]it is ſometimes deuided into two trunkes which lye deepe as doeth their roote; [char,35,37.]ſometimes it is diuided into three branches, [char,33,35,37,] whereof the exterior [ta,25,fig,2,char,33,]runneth along the outſide of the cubit whereuppon it beſtoweth branches and deſcendeth obliquely to the wreſt. The fourth. His diuiſion.

The ſecond which is the higher [ta,25,fig,2,ch,35,] runneth throughout the length of the wand vnto the outſide of the Hand [ta,25,fig,2,char,36,]and is conſumed or ſpent into two ſurcles which paſſe vnto the thumbe, two into the fore-finger and one into the middle finger.

The third [char,37,]deſcending by the length of the *vlna* or Ell, affordeth ſurcles to the muſcles that extend the fingers [chara,38,39,40,41.] and is conſumed or ſpent into the outſide of the wreſt intangling with ſome ſurcles at the roote thereof [chara,42,] the ioynt of the wreſt with the cubit.

The fift nerue of the Hand[ta,25,fig,1,and 2,*]taketh his beginning from the foreſayde complication, and being faſtned to the fourth runneth betweene the muſcles that extend and bend the cubite, (yet diſtributeth no branches to the *Radius* or wand) on the backeward and lower ſide thereof, and when it attayneth to the inner cauity of the proceſſe or protuberation of the arme, at the foreſide of the cubite it is a little reflected,and affordeth propagations [ta,25,fig,2,char,43,] to the muſcles which ariſe from the inner protuberation of the Arme,as alſo from the Ell and the wand, which muſcles doe not receiue any ſurcles from the third nerue. The 5. nerue.

From thence paſsing with a notable branch and being accompanyed with a veine and an artery it is faſtned to the Ell,and in the middle of the cubit is deuided into two braunches, [ta.25,fig,1,char,45, and 46,]one internall [char.45,] which is conuayed by the inſide of the Ell,amongſt the muſcles that bend the Fingers, & accompanyed with a veine and an artery is conducted vnto the wreſt;and vnder the tranſuerſe Ligament thereof vnto the palme of the Hand,where it ſendeth two ſurcles to the little finger,two to the middle finger,and one to the ring finger on their inſides. His progreſſe

The other externall branch[char,46,]at the middle of the Ell ſhooteth out a propagation from his outſide, between the muſcle that bends or extends the wreſt, which propagation runneth along the Ell,and is lengthned to the outſide of the cubite, and at the outſide of the wreſt beſtoweth two ſurcles on the litle finger, two on the ring finger and one on the middle finger. But wee muſt remember that the inner braunches are larger then the vtter, becauſe the vtter may more eaſily bee offended. Sometimes from this fift Nerue there are no ſurcles diſtributed to the inſide of the hand: ſometimes alſo the outſide of the inner part of the middle finger and the inſide of the ring finger do obtaine ſurcles from the third nerue,and then the fift doth onely exhibit two propagations to the inner part of the litle finger,and one to the inner part of the ring finger.

The ſixt Nerue,[ta,25,fig,1,and 2,*] which in bigneſſe is anſwerable to the ſecond where it attayneth to the cubit, creepeth through the inner and lower ſide of the Arme & of the cubit as far as to the hand, [ta,25,fig,1,char,47,]and neare the inner protuberation of the arme diſtributeth many ſurcles on each ſide into the skinne of the cubit;[Tab. 25,figure 1.char,48,] which ſurcles doe ſometimes lye vnder the branches of the *Baſilica* veine,ſometimes aboue them, and it determineth not farre from the connexion of the wreſt with the cubit [Ta,25,fig,1,char4-.] The ſixt.

Here we muſt note that which we touched before in the 24,Chap.that with the fourth, fift and ſixt Nerues of the Hand oftentimes there are mingled certaine ſmall braunches yſſuing from the fift Coniugation of the Brayne. And thus much of the Nerues of the Hand.

CHAP. XXXI. *of the Nerues of the foote in the large acception.*

The Nerues of the Legge.

THE nerues which at the beginning of the legge (by leg we vnderſtand here the whole member) doe run into the thighe and the foote, ariſe out of the ſpinall marrow, out of that part, I meane, which conſiſteth of the ſpondels or rackes of the Loines and of the Holy-bone; for they are propagated out of the three lower paires of the loynes; and the four vpper of the holybone, and in their very originall are mixed like as wee ſaide they were before they entered into the arme, for their coniunction is like the Meiſhing of a net or Plaſhing of a hedge, and ſo they proceede on either ſide in foure nerues. [Tab. 26. char. 57, 60, 66, 71] They are not all of alike thickneſſe, neither is their paſſage the ſame, although their common original be within the cauity of the *Peritonæum* or rim of the belly. The firſt and the third are the ſhorteſt, and therefore they paſſe onely vnto the thigh. The ſecond is longer & thicker then they, and reacheth through the thigh into the legge. The fourth is thicker then al the reſt put together and longer alſo, for it deſcendeth through the thigh and the Legge vnto the ends of the Toes.

Their original

The 1 Nerue

The firſt [tab. 26. char. 57] ariſeth of a commixtion of a branch of the third pair of the Loines with the fourth paire [about the 22. & 23 racke-bones] and is terminated aboue the ioynt of the knee. This nerue lying vpon the muſcles of the loines attaineth to the little *Rotator*, and is conſumed into the two extending muſcles of the thigh and a branch of it into the foreſide and outſide of the skinne of the Thigh that lyeth ouer them; but the greater part [char. 59] affoordeth ſurcles to the firſt, ſeauenth, and ninth muſcles of the Legge.

The ſecond.

The ſecond Nerue of the legge [Char. 60] iſſueth ouer againſt the coniunction of the third ſpondell of the Loines with the fourth, [betwixt 23 & 24] and being accompanied with the crurall Veine and Artery paſſeth through the groines into the Thigh, and deſcendeth in a notable branch, which on the inſide [char. 61] is faſtned to the vein *Saphena*, as farre as to the great toe paſſing by the inward Ankle. [char. 62] And this muſt eſpecially be noted becauſe of the Section of the hamand inner Ankle-veines, leaſt if the launcet or Flegme be bent forward you cut the nerue in ſunder: and as the *Saphena* in his deſcent communicateth diuers ſurcles, ſo alſo is this Nerue diuided into many braunches: the chiefe of which is that [char. 63] which we meete withall about the fore and inſide of the knee. The greater portion of this ſecond Nerue [char. 64] beeing accompanied with the *deepe* veine and artery is diſtributed into the forward muſcles of the thigh, eſpeciallie into the fift of the thigh and the eight of the legge; yet ſo, as it diſperſeth certayne ſmall ſhoots into the membranes that there tye the veſſels together.

The third.

The third Nerue [char. 66] ariſeth eſpecially where the fourth ſpondell of the loynes is articulated with the fift, and paſsing ouer the ſeauenth mufcle of the Thigh, it breaketh through the perforation of the ſhare-bone [char. 67] and reacheth ſurcles to the ninth & tenth muſcles of the Thigh, as alſo to the muſcles of the yard which ariſe from the ſhare-bone. It produceth alſo two Nerues that deſcend vnto the middle of the Thigh; one of which is ſprinkled into the skin of the Thigh neere the Groine, [char. 68] the other is conſumed into the ſecond Muſcle of the Legge, and into a part of the fift Muſcle of the Thigh.

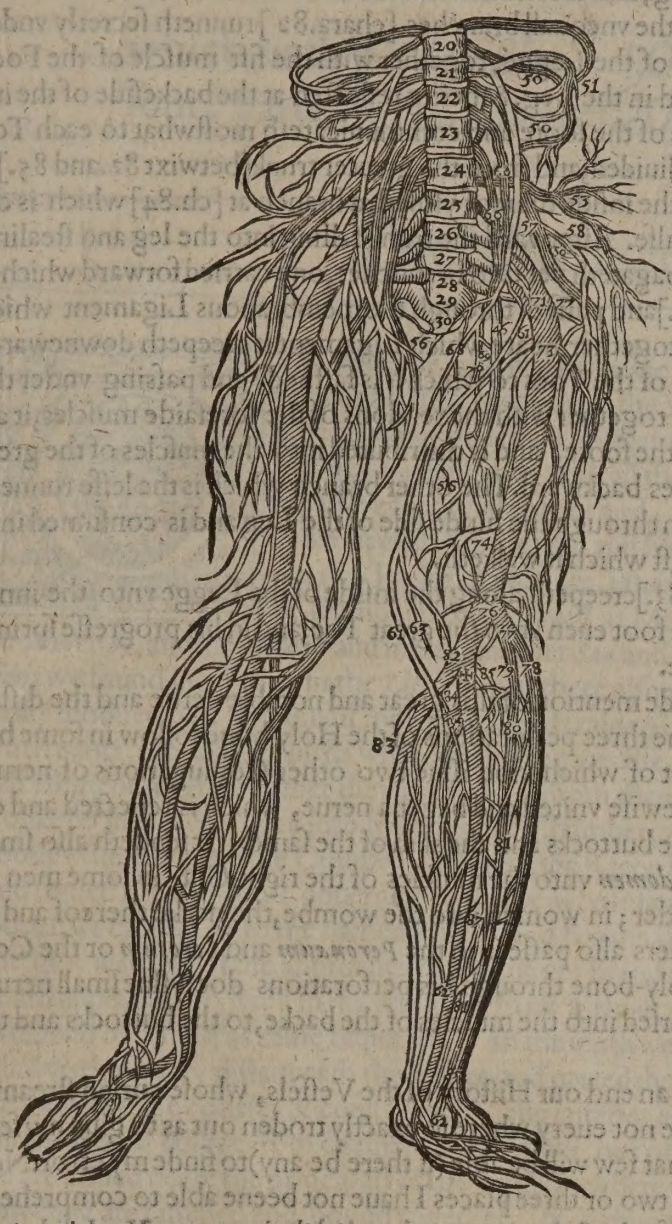
The fourth.

The fourth Nerue [char. 71, 72] is ſixe times as bigge as the thirde, yea to ſay true of all the nerues of the whole body it is the thickeſt, hardeſt, ſtrongeſt and drieſt. This is compounded of the foure vpper paires of the Holy-bone, or of the 25, 26, 27, & 28 coniugations. It goeth on the backſide of the thigh betwixt the *Holy* and the haunch-bones; for where they depart either from other it runneth in a peculiar cauity or *ſinus* of his own, and firſt ſhooteth out ſurcles from a branch lurking on the backeſide [char. 72] vnder the firſt muſcle to the skin which couereth the buttockes and the backeſide of the thigh euen vnto the middeſt thereof. Afterwards, it diſtributeth other branches on either ſide, [char. 73] which for the moſt part are three, vnto the heads of the third fourth and fift muſcles of the legge and the fift of the thigh. Thence forward it is hidden amongſt the Muſcles, and below the middle of the thigh ſendeth a branch [char. 74] vnto the fourth muſcle of the legge, and ſprinkleth propagations into the skin nere the knee. Next in the lower part it diſſeminateth on either ſide one ſurcle [char. 75] at the head of the thighe into the heads of three muſcles of the foote. But the trunke it ſelfe in the backward cauitie of the

His diuiſion.

knee

TABVLA. XXVI. *sheweth the Nerues of the foote in the large acception.*



From 20 to 24E. Fiue paires iſſuing out of the ſpondels or rackbones of the loynes.

50,50. *Nerues* going vnto the muſcles of the *Abdomen*.

5. Branches from theſe Nerues vnto the *broad* muſcle of the arme.

From 25 to 30. Six paire of Nerues of the Holy-bone.

53. A braunch of the paire 25 to the inſide of the haunch-bone, and the muſcles of the haunch-bone iſſuing therefrom.

56. The termination or end of the ſpinal marrow vndiuided.

57. The firſt Nerue running vnder the Legge or the Thigh.

58. Braunches going from this Nerue vnto the skin.

59. Hence alſo branches going to the Muſcles that occupy the outſide of the thigh.

60. The ſecond Nerue of the leg.

61,62. From this Nerue go branches through the inner ſide of the thigh and the leg vnto the loweſt part of the foote at 62.

63. Surcles from the branch 61 diſperſed into the knee.

64 A branch of the 2nerue running vnto the depth of the thigh.

65 Hence alſo a braunch vnto the muſcle of the thigh called *Triceps*.

66 The third nerue of the legge.

67 Propagations from this third nerue vnto the muſcles occupying the hole of the ſhare bone.

68 Another braunch vnto the skin on the inſide of the thigh.

69 A portion of the third Nerue lying deepe which goeth vnto the muſcles.

70, A portion to the ſecond bending muſcle of the Leg.

71, The fourth nerue of the leg which is the thickeſt of the whole body.

72, A propagation here of vnto the skinne on the backſide of the thigh.

73, Another propagation to the heads of the muſcles ariſing from the appendixe of the *Coxa*. 74 Another vnto the fourth muſcle of the leg and vnto the skin that is at the ioynt of the knee. 75, Surcles from the fourth nerue vnto the heads of the muſcles of the foote. 76, the diuiſion of the fourth nerue of the Ham into two trunks. 77, The leſſer and vtter trunk of this diuiſion. 78,78 A branch of the ſaid trunk ſtretched vnder the skin, and caried to the outſide of the legge and the Foot. 79, the greateſt part heereof betwixt the *Legge* and the *Brace* 80, A branch diſtributed vnto the fore-ſide of the Legge vnder the skin from the branch 79. 81, the greateſt part of the braunch 79 going vnto the muſcles of the foote. 82, The inner and thicker trunke of the fourth nerue of the legge in the ham. 83. A branch creeping along the inſide of the leg and of the foote. 84, A branch of the trunke 82 diſperſed into the skin of the Calfe. 85,85, A branch of the trunke 82 creeping through the foreſide of the leg vnto the top of the foote. 86, Another braunch creeping behinde amongſt the muſcles of the foote. 87, The remainder of the trunke 82 conueyed downe by the inner Ankle, and in his lower part affoording to euery Toe two ſmall ſurcles.

knee or in the ham [char. 76] is diuided into two branches of vnequal thicknes, [char. 77, 82] which are diſtributed into the whole legge and the foote: for the leg hath no branch from any nerue ſauing this alone vnleſſe it be a branch of the ſecond paire [ch. 61] which runneth through the inſide of the thigh, the leg and the foot; and yet ſomtimes a branch of this fourth nerue is faine to ſupply the place of that alſo.

The vtter of theſe two vnequall branches and the leſſer [char. 77] is preſently byfurcated; [char. 78,79] and the greater and vtter part of that byfurcation [ch. 78] which is produced preſently about the ham, deſcendeth along the *Braee* and the outward ankle to the outſide of the foote and the little toe, in his way offering ſurcles to the skin: The other and interiour part of the byfurcation which ſometime alſo is the greater, [char. 79] when The vtter branch.

it

it hath conueyed a branch [char.80] vnto the forepart of the legge, it is hidde neere the Brace among the Muſcles that are called *Pæronei* and affoordeth branches vnto them [ch. 81] From thence it ſtealeth along, and is returned toward the Vtter ankle.

The inner branch.

The *Interior* and greater of the vnequall branches [chara.82] runneth ſecretly vnder the muſcles along the backeſide of the Legge, together with the fift muſcle of the Foot & the bendersof the Toes ſeated in the Leg, & being reflected at the backeſide of the inner ankle attayneth to the ſoale of the foote and communicateth moſtwhat to each Toe two ſurcles. This branch is ſubdiuided, and from the greater trunk [betwixt 82. and 85.] a little vnder the diuiſion, and in the inſide thereof yſſueth a branch at [ch.84] which is diſtributed into the skin of the Calfe. Afterward the trunk falling into the leg and ſtealing vnder the muſcles thereof propagateth yet two braunches, one carried forward which is greater then the other [char.85.] and paſſeth through the membranous Ligament which faſtneth the Leg and the Brace together; neare which Ligament it creepeth downeward, affording ſurcles to the muſcles of the Toes to which it is faſtned, and paſsing vnder the tranſuerſe or annular Ligament together with the tendons of the foreſaide muſcles, it attayneth vnto the vpper parts of the foote, and is diſtributed into the muſcles of the great Toe and thoſe that leade the Toes backward. The other branch which is the leſſe runneth backward, [char.86.] and paſſeth through the hinde ſide of the Leg and is conſumed into the muſcles of the foote amongſt which it walketh.

His diſtributi on.

The leſſer Trunke [char.83.] creepeth along the inſide of the Legge vnto the inner ankle, thence to the inſide of the foot euen vnto the great Toe, and in his progreſſe ſprinkleth diuers ſurcles into the skine.

Columbus after he hath made mention of this great and notable nerue and the diſtribution therof, addeth; After the three perforations of the Holy bone follow in ſome bodies the fourth and the fift, out of which doe iſſue two other Coniugations of nerues which after their egreſſe are likewiſe vnited and beget a nerue, which is reflected and diſtributed into the muſcles of the buttocks and the skin of the ſame. It ſendeth alſo ſmall nerues into the inſide of the *abdomen* vnto the muſcles of the right Gut; in ſome men alſo vnto the muſcles of the bladder; in women into the wombe, the necke thereof and to the muſcles of the bladder: others alſo paſſe into the *Peronæum* and *Scrotum* or the Cod. Out of the backepart of the Holy-bone through his perforations doe yſſue ſmall nerues little and ſhort, which are diſperſed into the muſcles of the backe, to the buttocks and the skin of the backſide.

The concluſi on.

And ſo haue we brought to an end our Hiſtory of the Veſſels, whoſe curled ſtreames and wandring paſſages, if I haue not euery where ſo exactly troden out as to giue my ſelfe contentment: yet I preſume that few will be able (if there be any) to finde my error. Notwithſtanding, I confeſſe that in two or three places I haue not beene able to comprehend the meaning of my Authours, if at leaſt they comprehended their owne. Yet I did compare them diligently together; but it is no wonder that in ſuch intricate labyrinths and inextricable Meanders, he that is beſt acquainted with them ſhould ſome time be at loſſe, in which reſpect he that is beſt able to finde the fault, I hope will ſooneſt pardon the offence, I proceede in my taske.

The end of the Eleauenth Booke.

THE TWELFTH BOOKE,

which hath foure parts, { *Of Gristles.* *Of Ligaments.* *Of Membranes.* *Of Fibres.*

The Præface.

OVR Webbe now weares neare the Threds. The glory and beauty of this stately Mansion of the *Soule* we declared in the first booke. The outward walles we dismantled in the second. The Cooke-roomes and sculleries with all the houses of Office and roomes of repast we surueyed in the third. The Geniall bed and the Nursery we viewed in the fourth and fift. In the sixt we were ledde into the rich Parlor of pleasure, wherein we were entertained by a leuy of Damozels; one *Modest* as Modesty it selfe; another *Shamefast*, another *Coy*, another *Iocond* and merry, another *Sad* and lumpish, and a world of such *Passions* we found inhabiting in the *Little world*, there also we saw the curious clocke of the heart mooued by a perpetuall motion; the Heralds of honor, those nimble and quicke Pursuants, those agile spirits whose presence giues life, whose pleasance giues cheere & refreshment whether soeuer they are sent. From thence wee ascended in the seauenth Booke by staires of Iuory into the presence Chamber, where the *Soule* maketh her chiefe abode; there we saw the Counsell gathered, the Records opened, and Dispatches made and signed for the good gouernement of the whole family. From thence in the eight Booke we clombe vnto the battlements, and saw the watch of the Senses set to discouer and giue warning of the approches of enemies or friends. In the ninth we obserued the guard appointed to fetch in the prouision from without, to entertaine or giue the repulse, to defend or offend as cause required. In the tenth we discouered the Materials which filled vp the empty distances in the walles, and parted the roomes asunder. In the eleuenth we followed the courses & conuayances, the enteries and Lobyes which leade throughout the whole edifice from chamber to chamber, out of one office into another. Now we are ariued neare the principals of the building, where we may see how they are ioyned, how they are fastened and bound together, how they are couered and defended, how they are interlaced and intertexed. And finally, in the next and last booke wee shall with God to friend come vnto the Principals themselues and to the very foundation & groundworke whereon the whole Frame is raysed.

The first part, Of Gristles.

CHAP. I. *Of the definition, vse, and differences of Gristles.*

BEfore we come vnto the particular Histories of the Gristles, it will bee requisite to speake something in generall which may open their nature, vses, and differences. *A Gristle therefore is a similar part, cold and dry, made out of the thickest part of the seede gathered together by the power of heate, and ordained to secure the variety of motions, and to put by outward violence.* That it is similar is very manifest, because it is altogether like it selfe, the least fragment or particle thereof retaining the nature, temper, and name of the whole. The distinction of a Cartilage.

This Gristle if we will beleeue *Galen* is to be numbred in the list of those parts which are gouerned by themselues and do not gouerne others. It is cold because the heat soone vanisheth away, and dry for that the moysture is vapoured from it, whence also it becommeth hard but not so hard as a bone. The explication of the definition.

The matter of it is the crassament or thickest part of the seede. The efficient is heate, which

which is the immediate organ of the procreating Faculty, to which the *Altering* and the *Forming* vertues are assistant: yet is not this an extending heate, such as whereby the Membranes are dilated; nor perforating such as boreth the Veines and Arteries, but a more remisse degree which gathereth or curdleth the parts together, and is indeede proportionable to cold in outward things, there being nothing actually cold in a liuing body. But as a high degree of heate doth melt the Lead which caketh when it is lesse hotte though a great head do remaine yet in it; so it is in the body, the greater heate diuideth the parts and the lesser gathereth, or if we may so say, congealeth them.

The finall cause is expressed in the last particle of the definition, for although there be diuers vses of Gristles as we shall shewe by and by, yet these two are principall. First, to make the ioynts of the bones which are coupled by *Diarthrosis* more gladde or easy to mooue, and more secure and permanent. Secondly, to defend the parts vnder them from outward impressions or iniuries.

The Nature of a Gristle is much vnlike that of a bone, for saith *Aristotle*, when the bones are in any creatures wanting, the supply is made by Gristles. Their Tempers also are not farre asunder. Sense they haue none, because the creature should not be in perpetuall paine, neither indeed haue they any Nerues dispersed through them. Notwithstanding as we shall say in the next Booke there are some kinde of bones which haue Sense, The teeth for instance; So some Gristles seeme to haue Sense, as those of the Eye-lids, because certaine small Tendrils of Nerues do touch them.

How Gristles and Bones do differ.

Finally, saith *Laurentius*, a bone and a gristle do differ but *secundum magis & minus*. For bones are harder, drier and colder: yet we may say further, that all Gristles are transparant, smooth and polished, many bones vnequall and sharpe. Moreouer, a Cartilage or gristle hath no marrow, nor cauity, nor corners, or celles in it as bones haue, because there was no neede of them, for being not so thick or solid as a bone their aliment doth easily passe through their substance. Wee conclude therefore, that a gristle is of a middle nature betwixt a Bone and a Ligament, faster then a Bone and harder then a Ligament.

The vses of the Gristles.

The vses of the Gristles are diuers and those very admirable and wonderful. The first and most common vse is to helpe the motion of the bones which are ioyned with a laxe or loose articulation, for by the helpe of the Gristle the motion becommeth more easie, more secure and more permanent. More easie, for being smooth and polished, it leuigateth and maketh slippery the asperities or roughnesse of the bones, and so their heads become more glib or prompt in their motion. Whence it is that all moueable ioynts are crusted ouer with a Gristle. So also are the heads, & the *sinus* or cups or cauities of bones where they touch one another lined with a smooth gristle. They make the motion more secure, because the gristle encreaseth the hollownesse of the bone that so the articulation is not so easily luxed or put out of ioynt, as we may see in the articulation of the arm with the shoulder-blade, and in many others. Finally, by the inter-venting of the gristle the motion is preserued and made more lasting and dureable, for the extremities or ends of bones being very hard by their mutuall contaction and perpetuall attrition would haue bene worne and fretted, and so in time the motion would haue decayed, which inconuenience is auoided because they are compassed or lined ouer with a soft gristle.

The first

The second.

The second vse of Gristles is by yeelding to illude or break the occursation of outward iniuries, as when the bones are beaten or ratled together, or some other violence offred, which haply might breake a bone: for being of a middle nature betweene very harde and very soft, it cannot be easily broken, as that which is hard and friable or brittle, nor easily wounded or bruised, as that which is soft and fleshy.

Hence it is that the Extremities of many bones which are exposed to external offence haue gristles allowed them, as the Nose and the Eares. And these are the chiefe and primary vses of gristles: there are also many other by-vses, as some gristles like bones do sustaine some parts, some haue muscles affixed vnto them', and some doe sustaine or establish the vessels. Such are the gristles of the *Larynx* or Throttle and the Rough Artery as also those of the Eye-browes, into which as into a pale the beard of haires whereby the eyes are defended and infixed.

By-vses of the Gristles.

There is also a fourth added, as if they should be defences or muniments to safegard the parts subiected vnder them. So the gristles of the breast-bone and the ribs were made for the defence of the heart and of the lungs, although they make indeed the motion of the

the cheſt more eaſie, becauſe they follow with more readines then bones would, his diſtention and contraction. In like manner the ſword-like cartilage which wee call the breſt blade is thought to haue beene ordained to defend the midriffe and the mouth of the ſtomacke when it is diſtended.

A fift vſe of the Griſtles you may gather out of *Galen* his booke *de oſſibus*, that by their mediation as it were by a glew ſome bones might be conioyned. So the ſhare-bones are vnited by a Griſtle, and that kind of coniunction is called *Synchondroſis*. The fift.

I will adde alſo a ſixt out of *Galens* eleuenth booke *de vſu partium*, to ioyne hard and denſe bones with lax and rare, for it filleth or maketh vp the hollow holes of a rare or lax bone, and leuigateth or maketh ſmooth his rough ſharpenes. The fixt.

Finally, there are other and thoſe very many peculiar vſes of particular Griſtles. Some belonging to the ſight, ſome to hearing, ſome to ſmelling, ſome to diglutition or ſwallowing, ſome to reſpiration or breathing, ſome to apprehenſion & ſome to progreſsion, as partly hath beene and ſhall further be declared in the Hiſtory. Many peculiar vſes.

For the differences of griſtles they are to be taken from their ſubſtance, magnitude, figure, ſite, vſe, and connexion. From the ſubſtance or rather from thoſe things which follow the ſubſtance, that is, hardnes and ſoftnes; ſome griſtles are hard which at length become bony as thoſe that forme the *Larinx*; others are in a meane which doe neuer degenerate into the nature of a bone, as that which we call the *Epiglottis* or *Ouer-tongue*; others are ſoft which tye the ioynts together and carry in them the nature of a ligament, & ſuch are called χονδροσυνδεσμοὶ. From the magnitude; ſome are great and others are ſmall. From the figure, which is very diuers Griſtles haue diuers names, as *Enſiculata*, *Annularis*, *Scutiformis*, *Aritenoides*. *The blade Griſtle*, *the ring Griſtle*, *the ſhield Griſtle*, *the ewre Griſtle*. From the ſite, ſome are called vpper ſome lower, ſome fore ſome after, ſome internall ſome externall Griſtles. From the vſe wee may alſo gather differences and varieties of Griſtles. Some are made for motion, ſome to auoyde outward iniury, ſome for defence and ſome onely for ſupportation. The differences which are taken from Connexion are more neceſſary and therefore a little the more to be ſtood vpon. A griſtle therefore either groweth to a bone or maketh a part by it ſelfe. That which groweth to a bone, eyther tyeth two bones together, or elſe is onely faſtened to a bone. That which tyeth two bones together, eyther doth it by the interpoſition of common ligaments, as it is in the ende of bones that are connected by *Diarthroſis*, or immediately as in the ſhare-bones & the breſt-bone. That which is faſtened to a bone appeareth in the griſtle of the Noſe, in the breaſt-blade and that which groweth to the *Coccyx* or the Rump The griſtle which maketh a part by it ſelfe is by ſome called *Solitaria*, ſuch is the griſtle in the extremity of the Eye-liddes, ſuch are the griſtles of the *Larinx* or Throttle; of the rough artery, of the outward eares and of the *Epiglottis* or Ouer-tongue. The differences of griſtles.

But for more perſpicuity we will referre the whole hiſtory of the griſtles vnto three heads. Thoſe of the head, thoſe of the trunke, and the griſtles of the ioynts: the griſtles of the head are, of the Noſe, of the Eares, of the Eye-lids and of the lower Iaw. The trunk is diuided into the Spine and the Cheſt. The parts of the ſpine are the necke, the backe, the loynes, and the holy-bone. The griſtles of the necke are eyther behind or before. Behind, thoſe that tye the ſpondels together; before, the Throttle, the Rough artery, and the Ouer-tongue. The griſtles of the cheſt are thoſe in the extremities of the ribs, and thoſe of the breaſt-bone. The griſtles of the ioynts are ſome of bones receiuing, ſome of bones receiued, and of each of theſe ſome belong to the Hand and others to the Foote. A diuiſion of griſtles.

CHAP. II. *Of the Griſtles of the Face.*

OF the Eye-lids we haue ſpoken before in the third chapter of the eight book which we will not now repeate, onely heere remember that a great part of them are cartilaginious or griſtly, by which the opening and ſhutting of the eye is made equall, by which the violence of outward iniuries is better reſiſted, and in which the ſmall hayres that keep duſt and flyes from the eyes are infixed and ſuſtained, which otherwiſe would haue fallen if the lid had beene onely made of fleſh and membranes. The griſtles of the eie-lids

Againe, if they had beene bony, they would not haue beene ſo eaſily moued, and beſide, their hardnes would haue offended the coates within the eyes which are of exquiſite ſenſe. But this griſtle is very thinne that it might be a little tranſparant to caſt a little ſha-

dow

dow of the externall light vppon the Eye. There are two of them, one vpper and another lower; the vpper is greater in a man, and in thoſe creatures whoſe lower eye-lids are immoueable, or their motion, if it be any, very little and obſcure, whereas in Birds the griſtle of the lower lid is the greater. They are called ταρσοὶ, becauſe the row or beard of haires, which is ſet in ſo many perforatiõs made in the griſtle, are not vnlike a rank of rowers in a Galley. There is alſo another griſtle in the greater angle of the eye, which hath the figure and vſe of a Pulley deſcribed elegantly at firſt by *Falopius*. This Pulley hath a Canale or open perforation through which the tendon of the muſcle that mooueth the eie round is conuayed, but of it we haue ſpoken before. In the ioynt of the lower iaw there is a ſlippery and mooueable griſtle which hindereth leaſt the bones of the temples and the iaw ſhould by their mutuall attrition be worne, or when they are wearied with too much labour giue ouer their motion.

Of the outward eares.

The outward eares called in latine *Auriculæ*, are alſo griſtly, for if they had beene bony they might eaſily haue beene broken, and beſide would haue beene an impediment in our ſleepe.

Againe, if they had beene ſoft and fleſhy they would not haue retained their arched figure, and ſo the ayer ſhould haue beene ſhut out, or if it had beene admitted, a fleſhy ſubſtance could not haue repelled the ſound. Theſe griſtles are aboue, thicker and harder; below, thinner and ſofter till you come to the lap which is of a mixed nature between fleſh and griſtle.

Of the noſe are fiue.

The griſtles of the Noſe are fiue, the three anterior are faſtened to the circumferences of the bones, and two make the *Wings*.

Of theſe the two vpper are the broadeſt and adhere to the bones of the noſe [Tab. 12. lib. 8. fig. 8 from f to e] where they are broad and rough. From them they hang, and together with them doe forme the anterior cauity of the noſthrils and their lower part. Deſcending downeward they run out being faſtened together vnto the tippe or toppe of the Noſe, and the lower they goe the ſofter they are, in the very extremity degenerating as it were into a griſtly ligament. The third griſtle which is in the middeſt betwixt theſe two is called *Septum cartilagineſum*, the griſtlie partition, which groweth to the bony partition, for it depending forward groweth to the foreſaide griſtles throughout their length on the inſide. This is the griſtle which maketh the Noſe to riſe in the face, and diſtinguiſheth the two noſthrils, where alſo the bony partition aboue the region of the Pallate ſeparateth the perforation of the noſthrils from the Noſe vnto the Chops. To theſe three griſtles other two are annexed which make the wings of the Noſe called *ala* or *pinnæ*, becauſe like wings they ſhut and open the noſthrils, and they are tyed with membranous ligaments to the former griſtles on their inſide. Each of theſe griſtles is orbicular and ſo make the holes of the noſthrils round, and indeed they approch neare vnto the nature of a ligament.

Their vſe.

Moreouer they haue voluntary motion being drawne vpward and downward, inward and outward by proper and peculiar muſcles, and in great inſpirations they are a little eleuated, but in expirations do ſettle againe. They are ſeated in the lower part of the Noſe, for the vpper is bony to be a foundation vnto the reſt: but it behooued that the lower part of the Noſe ſhould be griſtly; partly that the cauities might remaine alwayes open for the better attraction of the ayer into the Lungs and into the braine; partly that being ſoft we might cloſe our Noſes againſt any euill ſauours, partly alſo the better to euacuate the excrements of the braine through the noſthrils; and finally that they might yeelde to outward violence to which they are moſt of all expoſed. This part of the Noſe if by any caſualty it ſhal happen to be cut off may be elegantly reſtored *by a Traduction of skinne out of the arme*, as we ſhal (God willing) at large diſcourſe and exhibit the figures of that kind of deligation in our worke of Surgery. And ſo much concerning the Griſtles of the Face.

CHAP. III. *Of the Epiglottis, the Griſtles of the Larinx and of the Weazon.*

Epiglottis.

OF the *Epiglottis*, the griſtles of the Throttle, and the Weazon we haue ſpoken before in the 18 chapter of the 6 booke, and in the 34, and 36 chapters of the eight booke; wherefore heere it ſhall be ſufficient to touch vpon thẽ and ſo to paſſe vnto the reſt that follow. You muſt therefore remember that the *Epiglottis* is nothing elſe but a griſtle that lyeth vppon the cleft or

ſlit of the Larinx made of the two proceſſes of the Ewre griſtle. The forme of it is compared to an Ivy leafe, whoſe baſis is broade but the cone not very ſharpe. The baſis is in the vpper and inner ſide of the ſhield griſtle, the cone vergeth toward the Pallate. If this griſtle had been bony, it would not ſo eaſily haue beene depreſſed in diglutition, nor readily againe lifted it ſelfe vp for the inſpiration of ayer. If it had beene fleſhy or membranous it would indeed haue eaſily fallen, but not ſo readily riſen againe. The vſe of it is double. The firſt to couer the Larinx, that in ſwallowing the meate and the drinke might not paſſe into the Lungs. The ſecond vſe is to breake the ayer that is driuen out of the Lungs and to Modulate the voyce.

This griſtle ſaith *Laurentius* ſtandeth alwayes yawning open, as well when wee draw in our breath as when we breathe it forth. Neyther is it at any time depreſſed of it owne accord but onely by the weight of the meate and drinke which we ſwallow, neyther at that time is it ſo exquiſitely cloſed vp but that a portion of the drinke ſipeth by into the Artery.

As the *Epiglottis* is the couer of the *Larinx*, ſo is the *Larinx* the head or couer of the Rough artery. The whole body of it is almoſt all griſtly, for being the Organ of Breathing it was neceſſary it ſhould euer be open whether we had neede to take in freſh ayer or to breath out old. The griſtles of the Larynx

Againe it is the Organ of the voyce which is nothing elſe but a percuſsion of the ayre. Now the ayer is not broken but at a ſolid, hard, and light body. It conſiſteth of three griſtles or rather of foure, which are ſo faſtened together that by them it may eaſily be dilated and conſtringed, ſhut and opened. The firſt is called *Thyroides* the ſhield-griſtle, becauſe it is like a ſquare ſhield ſuch as is carried before Tilters in their triumphs; and this is ſometime double, eſpecially in women, in whom likewiſe it buncheth not out ſo far forward as it doth in men. The ſecond is called *Cryeoides* the Ring-griſtle, for it is wholy circular and keepeth the pipe open. It preuenteth alſo the compreſsion of the reſt of the ſemicircular griſtles in the motions of the Larinx. The third is called *Arytænoeides*, or the Ewre-griſtle, becauſe it is like an Ewre with which we vſe to powre water vppon mens hands, or rather it hath this denomination from the ſimilitude it hath with an oyle cruiſe.

The firſt Anatomiſts accounted this griſtle ſingle, but thoſe that haue come ſince haue found it to be double, and that the parts therof are connected or knit together with membranes or with ligaments. And indeede theſe parts thus ioyned do make the *glottis* or cleft of the Throttle. The opening or cloſing of theſe parts make the voyce baſe or treble, but the *Epiglottis* ſtriketh a great ſtroke in it as it ſhutteth his cleft more or leſſe. *Columbus* ſaith that theſe griſtles do ſomtimes turne to bee bones. And thus much of the Larinx; now we proceede to the rough Artery.

The Weazon becauſe it is a vocall Organ or wind inſtrument, fiſtulated or made hollow to lead ayer vnto the Lungs and to returne out of the fumid vapours the recrements of the ſpirits, it was for the greateſt part made of griſtles, and thence it is called τραχεῖα, *Arteria aſpera* becauſe it is aſperated or made rough and vnequal with griſtlie rings. Now a griſtle is the fitteſt inſtrument of the voyce becauſe it is of a middle nature betwixt harde and ſoft, for ſoft things becauſe of their weakneſſe doe ſtrike the ayer more remiſly, and hard things doe eaſily ouerturne it. The Weazon

Why Griſtly.

Theſe griſtles are like rings, not round rings, for on the backpart where they touch the gullet they end into membranes, ſo that they are but ſemicircular like the letter C, from whence alſo they are called σιγμοειδεῖς. Theſe griſtles ſaith *Laurentius* do not onely run as far as the Iugulum as ſome haue dreampt, but throughout the whole courſe of the artery they are in all his branches that paſſe into the whole fleſh of the Lungs.

The reaſon why theſe griſtles were not made perfectly circular, I thinke was, as well that the Gullet ſhould not be hurt with the hardneſſe of the artery, as alſo that we might ſwallow the more freely, for oftentimes wee ſwallow hard and vnbroken bittes which would out of doubt offend vs vnleſſe the artery did yeeld vnto the Gullet. Why the rings are not round.

It may be obiected that the body of the Larinx or Throttle is wholy griſtly, and yet it hindereth not the Gullet.

But there is a great difference betwixt theſe, for in deglutition or ſwallowing the Gullet is drawne downeward but the *Larinx* runneth vpward, ſo that the ſituation of thoſe

parts is changed, and the beginning of the Gullet approcheth vnto the rough artery, but the throttle aſcendeth as high as to the chops.

Moreouer theſe griſtles are ſemicircular onely in the vpper part as low as the *Iugulum*, but when they are paſt the *Oeſophagus* and come vnto the Lungs, they grow round becauſe it was neceſſary that the artery in the Lungs ſhould be kept open for the freer traction and expulſion of the ayer. He that deſireth further ſatisfaction concerning the nature of theſe griſtles, let him repaire to the 18 chapter of the 6 booke.

CHAP. IIII. *Of the Griſtles in the Trunke or Bulke of the Body.*

The griſtles of the Spine.

THE Griſtles that are in the bulke of the body are eyther in the rack-bones of the Spine or in the Cheſt. In the ſpine there are many griſtles to eſtabliſh the articulation of the ſpondels, and to make their motion more facile and eaſie. All the *vertebræ* of the necke haue griſtles aboue and below, excepting the firſt, ſo is it likewiſe in the backe and in the loynes. But thoſe of the holy-bone are harder and drier then the reſt becauſe the whole bone is immoueable.

The extremity alſo of the holy-bone is griſtly, and is called *Coccyx* or the Rump. It carrieth the figure of a Cornet or paper wherein Grocers vſe to put vp their Spices, ſauing that the cone or ſharpe end is ſomewhat beaked or crooked. This eſtabliſheth the right gut, as alſo the neck of the womb and the bladder, and when women are in trauel it is bent backward not without very great paine.

Of the griſtles of the Cheſt.

For the cheſt it behooued well that ſome part of it ſhould bee griſtly that it might more eaſily follow our inſpiration and expiration. Firſt therefore there are two griſtles which ioyne the clauicles to the breſt-bone. Then the *Sternon* or breſt-bone hath a griſtle in the vpper and another in the lower part. In the vpper part betwixt the firſt and the ſecond bones which ſerueth inſtead of a ligament, but below appeareth that notable griſtle which they call *Xiphoides* or the breſt-blade. The forme of this griſtle is very diuers, for it is not alwayes acuminated or pointed; but ſometimes broad in the end, and ſometimes tyned or diuided into two forkes and thereupon ſome haue called it *Furcella* the little *Forke*. Oftentimes ſaith *Laurentius* we haue ſeene it round like the *Epiglottis*. Sometime the parts are vnequall, and the leſſer lyeth ouer the greater like the leafe of the herbe which we call Horſe-tongue, about the middle of it it is perforated with a ſmal hole which few haue obſerued, made to tranſmit a nerue and a veyne.

the breſtblade

The vſe of it.

The vſe of this griſtle is the ſame with other griſtles which hang at the ends of bones to witte, by yeelding to breake the violence of outward iniuries, and to defende the parts ſubiected thereto. Some thinke it was made as a defence for the midriffe which in that place is neruous; ſome to ſafegard the mouth of the ſtomacke, hence ſay they often comes a *Nauſea* or loathing of the meate when this griſtle is bent inward and preſſeth the mouth of the ſtomacke. Some of the Neotericks or new VVriters do deride this latter vſe, becauſe ſay they there is a great diſtance betwixt this griſtle and the mouth of the ſtomacke which is applyed to or leaneth vppon the backe, but *Laurentius* ſaith it is falſe that there is any ſuch diſtance in liuing bodies, for firſt they that vomit much when they are about to caſt, do find a paine at this griſtle.

Againe, *Hippocrates* in the third ſection of his booke *de Articulis* hath remembred ſuch a diſtention of the ſtomacke to the foreparts where he ſaith *That the repletion of the belly* (he meaneth the ſtomacke) *is a direction for broken ribs.*

Moreouer in *Coacis* he calleth the mouth of the ſtomacke *Sternum*, where he ſpeaketh *of the bitternes and gnawing of the Sternum*, that is, of the mouth of the ſtomack; but aboue all that is abſurd with old wiues fable, who ſay that this griſtle ſomtimes fals away and may be replaced againe by muttering a peece of the mattens ouer it, and by attrectation or groping vppon it.

Two griſtles in each rib.

Finally, euery rib hath two griſtles, one on the backſide where it is articulated to the ſpondell: another on the foreſide by which it is ioyned to the breſt-bone. But the forward are greater and thicker then thoſe that are backward, becauſe the forepart of the cheſt is diſtended and contracted. The griſtles alſo of the baſtard ribs are longer then thoſe of the true ribs. And ſo much for the griſtles of the Trunke.

CHAP.

CHAP. V. *Of the Gristles of the Ioynts.*

THere is almost no Ioint in the whole body of Man, but for his more secure and facile motion it is crusted ouer with a Gristle, as partly wee haue shewed before in particular. Moreouer in the cauity or hollownesse of the Shoulder-blade Nature placed a Gristle to increase the *sinus* or bosome of the bone, least in violent motions the ioynt should bee easily luxed or put out.

In the lower part of the Cubit which hath an acute or sharpe processe there appeareth a gristle which filleth vp the empty distance. It hindereth the Hand when it is led to the side frō offending against that acute processe. Betwixt the Share-bones there is a thick & hard gristle so vniting them together that it is not credible they shold be seuered in the time of trauell, as we haue shewed before in the 33. Question of our fift booke. In the cauity of the hanch-bone there is another gristle which increaseth the compasse of the bosome or cauity therein. Of the cubit. Of the hanches.

Finally, in the lower heads of the thighes we finde two semicircular gristles which inlarge the lippes of the cauities. In a word almost euery articulation is cursted ouer with a gristle to make the motion more easie, more secure and more permanent: and so much concerning Gristles. Now we proceede vnto the Ligaments.

The second part of Ligaments.

CHAP. VI. *Of the Nature, Vse and differences of Ligaments.*

AS the lubricity of Gristles makes the motion of the Bones more nimble and quicke: so the Ligaments doe secure both motion & articulation: but there is a double acception of a Ligament, the one large, the other presse and more restrained. In the first Sense we call any thing a Ligament which tyeth one part to another. So *Hippocrates* calleth the skin and the flesh *colligations*, the ancients also called all manner of vessells Veines, Arteries and Sinnewes, *Common Ligaments*. In the presse and strict signification wee call that a Ligament which is a hard and firme body, yet laxe and flexible and without sense, which incompasseth, tyeth downe and contayneth the ioynts. A double acception of a ligament.

This kinde of Ligament properly so called, the Grecians call σύνδεσμος, the Latins *copula, vinculum & Ligamentum*, wee may call it a *Tie*, but because the worde Ligament is growne into common vse, we will if you please retayne it for the most part, *Laurentius* giueth this definition of a Ligament. It is a similar cold and dry part, of a middle nature betwixt a Nerue and a Gristle (betwixt a Membrane and a Gristle sayth *Bauhine*) ingendred by the power of heat out of the slimy part of the Seede, and being of great vse in colligation, contayning, inuesting and forming of Muscles. Concerning the Temper of a Ligament (which is the forme of the similar part) all men do agree that it is cold and dry, albeit some peculiar ligaments of ioyntes are lined ouer with a mucous and slimy humour, but concerning those things which accompany, follow and happen to the temper many haue made scruple: hardnesse and softnesse followe the temper, sense and motion happen vnto it. We resolue that Ligaments are of a middle Nature betwixt Gristles and Membranes harder then Membranes; least in vehement motions they should bee broken, and softer then Gristles, that they might more easily follow and obey the Muscles which moue the bones. For the most part they are all insensible, as well because they receiue no Nerues into them, as also least being perpetually moued they should breed perpetuall payne. The definition of a ligament.

It may be obiected that *Galen* in his 3. booke *de facultat. natural.* sayth that Ligaments consist of sensible fibres, but we must know that by *sensible* in that place *Galen* vnderstandeth not that which hath Sense, but that which is liable to Sense, not that which is sensatiue but that which is sensible. For Ligaments borrow nothing from the brayne, and therefore haue no sense, neither can they mooue themselues, notwithstanding as among the bones the Teeth haue sense, among the gristles those that make the Eye-liddes, so amongst the Ligaments there are some which haue the sense of touching, as the two ligaments that make the yarde, and the reyne or bridle of the Tongue

The matter of ligaments,

The matter of Ligaments is the slimy part of the seed extended or lengthned by heat, whence it is that they can bee contracted and againe relaxed. Their Aliment I doe not take to be (sayth *Laurentius*) as some would, marrow, but bloud conuayed vnto them by *Capillary* veines, which are so little that they cannot be perceiued.

Their vses.

The vses of Ligaments are diuers, the first and most common is to firme and assure the articulations, especially those that are more laxe of the bones and the gristles and to hinder luxation, for it was to be feared that when the bones are separated in violent motions they should be also distracted, vnlesse the wisedome of Nature had prouided to tye their extremities together with strong and straite bonds. These Ligaments which performe this vse are either common which compasse the ioynt round about, or priuate. The common are thin and membranous, the proper are thicker and most what round.

Their second vse is to bind and fasten the bones where they are not articulated, for there are thinne and fine Ligaments which tye the cubite to the *Radius* and the Legge to the *Brace* where they gape asunder, as also the spines of the spondels.

The third vse is that which *Galen* remembreth, who sayeth they serue for an outward garment to defend the tendons. So the tendons which bend and extend the Fingers & the Toes are throughout their whole length couered with Ligaments & with mẽbranes.

Adde hereto the fourth to contayne the Tendons in their owne places, to establish them and safely to transmit them from one place to another. Such are the Transuerse Ligaments of the wrest, round like a ring and therefore called *Annularia*.

Fiftly, they are interposed like a pillow betwixt the bones and the Tendons, that the hardnes of the bones should not offend the tender and sensible tendons.

Sixtly to discriminate or separate the right muscles from the left, the fore muscles from the hinder, and other parts one from another as we may see in the Ell and the *Wand*, in the *Leg* and the *Brace*.

Seauently to encrease and augment as do the gristles the *Cups* of the bones.

Eightly, to suspend the bowels that they should not fall with their great waight. Such are the Ligaments of the Liuer, the Bladder and of the Wombe.

Finally, they concurre vnto the structure of a muscle, for of the fibres of a nerue and a ligament mixed together is a tendon made.

The differences of ligaments.

The differences of Ligaments are to be taken from their substance, magnitude, figure, site, originall, insertion, vse, and from their principall parts. From the substance some are soft, some hard, some membranous, that is, like vnto membranes, becaus they be broade. Some are neruous, that is, round like nerues, some are gristly. From the magnitude some are little some are great, some are broade and some are narrowe. From the figure some are broade some are round, some are continuall some are perforated, some are transuerse and annular and some are long and direct. From their situation they are supernall infernall, right left, fore and backe Ligaments.

From their originall and insertion their diuision is very elegant, some arise from bones, some from gristles, & some from membranes. Those which arise from bones are inserted either into a bone or into a gristle, or into the heads of muscles, or into some other part. Of those which arise from a bone and are inserted into a bone, some do firme the ioynts, others tie the two bones together without a ioynt, others defend and inuest the tendons. Those which arise from a bone and are inserted into a gristle doe appeare in the knee, one from the internall roote of the inner *Cup*, the other placed vnder it. Those that are inserted into the heades of muscles are very diuers, some grow out of bones and runne into other parts, as that double Ligament which maketh the greatest part of the yarde, and ariseth out of the share-bones. Those Ligaments that arise out of gristles are some of them inserted into gristles; such are they that tye together the gristles of the *Larynx*; they that are in the end of the Rump and those that tye together the halfe circles of the Rough artery; others are inserted into the heads of muscles, as those that runne into the proper muscles of the *Larynx*. Those ligaments that arise from membranes are but few.

From the vse you may gather diuers differences of Ligaments according to the vses before named.

Finally, from the principal or more notable parts of the body we may very fitly deuide Ligaments into those of the Head, those of the Chest and Back, and those of the Ioynts, according to which diuision we will now prosecute their particular History.

CHAP

CHAP. VII. *Of the Ligaments of the Head.*

THE Ligaments of the Head doe some of them belong to the whole Head, some to particular parts thereof: the whole Head is mooued aboue the first and the second *vertebra* or spondell of the necke, wherefore it was needfull that it shold be fastned with strong ligaments, otherwise a notable part had bin in danger of luxation. Of these Ligaments *Bauhine* reckoneth 4, *Laurentius* but three, which notwithstanding (sayeth hee) may bee deuided into more particles. The ligaments of the head.

The first is a very great and broade Ligament which tyeth the first Racke-bone vnto the Head and compasseth the whole ioynt round about. It hath two portions, one like a thicke membrane and runneth to the inside of the first spondel, the other part compasseth about the outside of the ioynt. It ariseth out of the *Basis* of the *occiput* or Nowle of the head, which is therfore exasperated, and in young children is scotched or cleft manifold: hence it is that the first and second *vertebræ* may sooner be broken then luxated. The first.

The second Ligament fastneth the processe of the second Rackbone called the *Tooth* to the head, and it consisteth of three parts. Two arising from the outside of the *Tooth* are inserted into the inside of the circumference of the hole which is in the nowle-bone. The third is round like a nerue and ariseth from the foreside of the *Tooth*, and is infixed likewise into the hole of the Nowle to which it adheareth very strongly. Second.

The third Ligament is very like a nerue and made with wonderful art, and compasseth the cauity of the first Racke-bone which was made to receiue the Tooth of the second, & constringeth the sayde tooth, so firming it that it cannot incline to either side; it safeguardeth also the spinall marrow least it should offend against the bare bone. Third.

The fourth Ligament ioyneth the second Racke-bone to the first. It is membranous and of the same nature and vse with the other ligaments of the ioyntes; and these are the common ligaments of the head. There are also other proper ligaments in the head which belong to particular parts: as the ligament of the gristle of the Eare: a strong ligament, for it fastneth the roote of the gristle to the stony-bone, and ariseth with diuers propagations from the *Pericranium*, where it tendeth toward the *Mammillary* processe. These propagations when they come vnto the eare do grow together into one ligamēt & it is inserted into the vpper & gibbous part of the eare to hold the gristle pricked vp & suspended. Fourth. Of the ligament of the eare.

There is a ligament also in the Eye called by *Falopius*, *Ligamentum Ciliare*, not because it is of the nature of a ligament, but because the grapy coat is thereby fastned to the verge or circumference of the membrane of the Christalline, but wee haue spoken of it sufficiently before in the end of the 7. Chapter of the 8. Booke. Of the eie.

The Ligaments of the vpper Iaw betweene the *sutures* and the *harmonies* are thin and membranous, made for the original of the muscles, for from them the tendons of the muscles of the Face and of the neighbour partes take their originall. The articulation also, sayth *Galen* in the 20. Chapter of his first booke *de vsu partium*, of the lower Iaw with the Temple bones hath strong ligaments, which *Bauhine* out of *Platerus* calleth a common membranous ligament incircling the whole ioynt. Of the Iaw.

The Ligament of the Tongue *Galen* discourseth of in the 10. chapter of his 11. booke *de vsu partium*. It is strong, membranous and broad, but of it wee haue spoken before in the 32. chapter of the 8. booke. Of the ligaments of the bone *Hyois* we shall speake in the booke of Bones. Of the ligaments in the Heart, in the Rough Artery and the cutany ligament of the wombe we haue spoken before in their proper places, which wee will not now stand to repeat, but proceed on vnto the ligaments of the Spine and the Chest. Of other parts.

CHAP. VIII. *Of the Ligaments of the Spine and the Chest.*

THE motions of the Spine are very diuers, and therefore the Rack-bones stood need to be fastned together with ligaments. In these Rack-bones we may obserue their bodies and their processes. In like manner there are two sortes of ligaments, one kinde fastneth the bodies of the spondelles, another their processes, and these saith *Bauhine* are of two sorts, the one is strong and mucous, which compasseth the bones and fastneth the whole length of the Spine; in violent motions downeward and great burthens securing it from danger. Liga. of the Spine.

The other sort is gristly, and *Galen* indeed in his Booke *de ossibus* calleth them Gristles, which kinde goeth betwixt the bodies of the spondels and fastneth them strongly together.

It is fibrous and mucous, thicke without, but toward the middest attenuated, and carrieth the very forme of the spondell, answerable to it in breadth and length, and determineth into the gristle which is betwixt the spondels.

The ioyntes of the processes are also fastned with common membranous ligaments, the ascendents with the descendents. Furthermore there is another priuate or particular Ligament and yellowish, arising out of the inside of the hole of the Rack-bone at the roote of the backward processe betwixt two ascending or descending processes, and is againe inserted into the same place of the subsequent spondell.

In the necke of a Dogge wee meete with a Ligament which is rare indeede but strong and yellow, and cannot be parted into fibres. It groweth out of the very top of the spine of the seauenth Racke of the necke, and ascending vpward free and at liberty is fastned into the top of the second spine of the necke. In sheep it groweth to the Nowle-bone. In beastes of burthen it is very thicke for more strength, and of all the Ligaments of the body is refused for meat; yet sayth *Vesalius* some commend it to be eaten to make the haire grow long. It may be (sayth he) because it is easily dissolued as it were into yellow haire. In some creatures throughout the length of the backe runneth a Ligament on each side betweene the muscles that moue the backe, which sayeth *Vesalius*, *Galen* also attributes to men in his bookes *de vsu partium*.

Of the chest. The Chest also hath his Ligaments for all the ioynts thereof are ioyned with common membranous Ligaments compassing them about. So the ribbes are fastned to the spondels with strong and almost gristly Ligaments, especially in the first and second rib because of the burthen which they were to beare; likewise in the twelfth, because it is not sustayned with a transuerse processe. The same ribs are ioyned by the mediation of Ligaments to the gristles of the breast-bone. The bone also of the Breast it selfe is fastned to the clauicles by the interposition of a proper Ligament.

CHAP. IX. *Of the Ligaments of the Shoulder-blade, the Arme, the Cubit, and the Wand.*

THE head of the Arme being round that the whole Hand might moue speedily euery way, and the cauity or *Cuppe* of the Blade being but shallow; (as whose browes are narrow) least in the diuers motions the Arme should bee luxed, Nature partly by two recurued processes of the blade, partly by Ligaments which defend the ioynt, hath prouided for so desperate an inconuenience.

Fiue ligaments of the arme. These Ligaments are fiue. The first is *Broade*, so *Galen* calleth it, and membranous like the Ligaments of other ioyntes. It taketh his originall circularly out of the verges or browes of the necke of the Blade, incircleth the whole ioynt about, and is infastned on the inside of the beginning of the head of the Arme, and is implanted to the outside of the head and into both their necks.

The second is perfectly round, as also is the third, and groweth from the top of the *interior* processe of the Blade, and compasseth about the inside of the vtter heade of the Arme whereto it groweth very strongly.

The third is thicker and greater then the former and ariseth out of the vpper part of the necke of the Blade, and climing ouer the head of the arme, is inserted into the outside thereof, where at his cauity the outside buncheth out somewhat, so that these two Ligaments together make as it were one transuerse Ligament.

The fourth is broade also and yssueth out of the same place with the third. His originall is large, and runneth obliquely till it be infixed into the backeside of the vtter head of the Arme where it compasseth the backepart of the ioynt as did the first.

The fift yssueth from the *interior* processe of the blade and runneth vpward to the top of the shoulder.

The vse of these Ligaments is; of the first the same with the Ligaments of other ioints; of the three next to keepe the arme that it fall not downeward or outward out of his socket. Of the fift to keepe the arme from luxing forward, in which seruice it is holpen by the outward head of the double headed muscle.

For

For the Cubit, although throughout his length all the muſcles are compaſſed with a ſtrong membrane which faſteneth them together, holdeth them in their places, and like a tranſuerſe ligament as it were bridleth them vp growing to them very ſtrongly and cloſely as the proper membrane of a muſcle doth; yet there are other ligaments which ioyne the bones together. VVherefore the cubit, which is compounded of the El and the VVand, hath ligaments wherby it is faſtened to the arme, to the wreſt, & alſo the two bones of the cubit together. To the arme it is faſtened with common ligaments, ſtrong but membranous, which tye the Ell to the arme and the wand to the vtter protuberation of the arme. But to the wreſt it is articulated with a membranous ligament common to other ioynts, and beſide with two proper round ligaments, one faſtened to the Ell which runneth from the proceſſe called Styloides vnto the fourth bone of the wreſt and is more griſtly then the reſt; the ſecond faſteneth the wand to the wreſt, for it iſſueth out of the top or pitch of the wand and runneth into the wreſt. The ligament of the Cubit.

Againe, theſe two bones of the Ell and the Wand are vnited by a common ligament aboue and below, as alſo by a peculiar which is membranous & ſtrong running throughout the whole length of both bones, for his ſituation is in the diſtance betwixt them, ariſing from an acute line of the Ell, and inſerted into a line of the Wand. It hath alſo oblique fibres which creepe downeward obliquely from the Wand vnto the Ell.

The vſe of this ligament is to conioyne and faſten theſe bones together, to diſtinguiſh the exterior muſcles from the interior, as alſo to offoord an originall to ſome muſcles, or at leaſt to adde ſtrength to their originals. Their vſe.

CHAP. X. *Of the Ligaments of the Wreſt, After-wreſt, and the fingers.*

THE bones of the VVreſt haue common Ligaments with which they are in a manner inueſted, for ſomtimes and in ſome places they get betweene the bones and become griſtly. This common ligament iſſueth from the lower appendix of the Ell and the VVand. It is very ſtrong and ſo faſteneth the bones that they become fit for their proper motions which are indeede but obſcure, for they are implanted into the appendix of the bone of the After-wreſt. the ligaments of the wreſt.

The bones alſo of the After-wreſt are faſtened together by common ligaments, which doe not onely compaſſe the bones orbicularly, but alſo, neare their extremities in the middle where the bones doe meet one with another, they inſinuate themſelues, becomming of the nature of a griſtle, ſo as they paſſe againe outward and ioyne the bones of the After-wreſt to the wreſt. Of the After-wreſt.

Finally, the knots or knuckles of the fingers are faſtened together with common Ligaments, beſides which there are yet in the hand other ligaments which do not ſerue to articulate or ioyne the bones, but do onely incompaſſe and containe the tendons that go vnto the fingers, leaſt when they are moued they ſhould ſlippe out of their places. This kind of ligament is double, one at the inſide of the wreſt tranſuerſe and broade, ſtronger alſo then the reſt of this kind. It compaſſeth the wreſt like a bracelet on the inſide eſpecially, and holdeth together al the tendons that fall downe to the hand: from it alſo ſomtimes proceedeth the tendon of the muſcle called *Palmaris*. Of the fingers

The other ligament is on the outſide where the wreſt is articulated to the Cubit. It taketh his originall from the two forenamed appendices or out-ſhootes, and is ſpread ouer the whole breadth of the Cubit.

At the firſt ſight it ſeemeth to bee but one, but when it is diſſected it appeareth to bee ſixe tranſuerſe ligaments, which like Rings are ſhot ouer the tendons of the muſcles that extend the fingers, whereby thoſe tendons are contayned or faſtened together. 6 tranſuerſe.

The firſt proceedeth out of the Ell into the VVand and runneth vnto the Sinus or cauity which is common to them both and is peculiar to the ſixt muſcle that extendeth the fingers.

The ſecond belongeth properly to the Ell and to the firſt extending muſcle of the wreſt.

The third is proper to the VVand and to the extending muſcles of the forefinger, the middle finger and the Rin-finger.

The fourth is an exceding narrow Ring belonging to the ſlender tendon of the muſcle that leadeth the fore and middle fingers from the thumbe.

The fift maketh a way for the ſecond extender of the wreſt, and for that muſcle which

turneth

turneth the thumbe toward the forefinger: ſometime alſo a peculiar ligament couereth the tendon of the Thumbe.

Finally, the ſixt tranſmitteth the three tendons of the ſecond muſcle that extendeth the Thumbe.

Other Ligaments of the Fingers.

Moreouer, euery finger hath ligaments which run throughout their length, ariſing from the ſides of their inner bones which are long and like canales; theſe do containe or keepe the tendons that bend the fingers in their cauities, leaſt in the flexion they ſhould ſtrut vp out of their place or goe aſtray.

To conclude there are other membranous Ligaments, or rather mucous membranes, but redder then the other membranes of the Tendons, which after the manner of Ligaments couer the Tendons that are tranſmitted to the hand and the fingers, involuing them for their more ſecurity, from which ſometimes the muſcles take their originall, & ſo much of the Ligaments of the Hand.

CHAP. XI. *Of the Ligaments of the Holy-bone, the Hanches, and the whole Legge and Foote.*

IT remaineth now that we proceede vnto the Ligaments which tye the Hanch-bones and bones of the *Coxendix* and Holy-bone, as alſo thoſe that faſten the ſhare-bones and which belong vnto the legge.

The Lig. of the hanch.

The ligament which tieth the hanch-bone to the holy-bone is a common ligament, broad, membranous and ſtrong, yea in that part where it goeth betwixt the bones it ſeemeth both in ſtrength and thickneſſe to be griſtly, the better to conſtringe and faſten that looſe coniunction. Hence it is ſaith *Bauhine*, that in the trauell of a woman, if the impreſsion be more violent, the connexion wil yeeld ſomewhat.

Of the Holie-bone.

That which tieth the holy bone to the Coxendixe is double, one ariſeth out of the coniunction of the fift and ſixt holy bones, and is infixed into the acute proceſſe of the *Coxendix*, the other ariſeth indeed out of the ſame place, but is inſerted into the poſterior part or appendix of the coxendix to faſten the bones the ſtronger together. Anatomiſts alſo do conceiue that this ligament was ordained to ſuſtaine the right gut with his Muſcles vnder which there is no bone.

The Share-bone.

The ſhare-bones although they be faſtened together by the interpoſition of a griſtle, yet haue they a double Ligament, one which compaſſeth them about circularly, leaſt in the trauell of the birth, or other great and ſtrong motions of the thigh they ſhold be broken, which might well haue hapned if there had bene nothing but bones; the other ligament is that which occupieth the perforation; membranous it is and conſiſteth of fibres that run obliquely downward, for becauſe it was fit that the ſhare-bones ſhould be light a great part of it is as it were turned out, and a ligament ſubſtituted as wel to ſuſtaine the Muſcles that belong to the bone, as to diſtinguiſh the two *Obturators* or the ninth and tenth muſcles of the thigh. The ligaments of the legge are threefold. Some are referred to the articulation of the thigh, others to the articulation of the legge, and others to the articulation of the foote.

Of the legge.

Of the Thigh two.

The thigh is faſtned to the ioynt of the Coxendix by a double Ligament, one common and membranous which circumcircleth the ioynt, and this the Grecians call ἰσχιος, by the name of the whole ioynt, becauſe it is much thicker, harder & ſtronger then other Ligaments that compaſſe the ioynts; which ſtrength was wel prouided for by nature, for the motions thereof are very ſtrong, and beſides it ſuſtaineth the whole body. This Ligament lieth vpon the ioynt and the necke of the thigh, but groweth onely orbicularly to the root of the great proces that the motions of the head of the thigh might not be hindred. The other ligament of the Thigh is round, and becauſe of his hardneſſe may be called a griſtly nerue. It is ſeated in the cup of the Coxendix, and ariſeth out of the depth thereof where the cauity is lined ouer with fat to make the head mooue more glib, and where the brow or brim of the cup ceaſeth: and is inſerted into the middeſt of the head of the thigh on the top thereof, that it might not eaſily fal out of the ſocket; for the thigh is heauy, and hangeth as it were down from the Coxendix, wherfore when this ligament is laxed and becommeth longer luxation oftentimes enſueth, yea ſometimes it is broken, and although the bone be reſtored, yet the patient is alwaies lame after, becauſe the two bones do not adhere ſo cloſe as they did before.

The firſt.

The ſecond.

Next

Next follow the Ligaments of the Legge and the Brace. The first Ligament of the legge is membranous and common, which compasseth the whole knee, except that part which the whirle-bone together with the tendons containing it doth occupy, for that is sufficiently constringed and contained by them. The ligaments of the Legge.

The other is seated in the backside or in the inside of the knee; strong it is and neruous and groweth out of the processe of the legge, and being forked or tined, is fastned vnto the lower head of the thigh on either side. The third is exceeding strong and gristly, growing out of the prominent part of the legge betwixt the cauities thereof, and is inserted into a middle canale or bosome betwixt the two heads of the thigh on the backside. The fourth is slender and mucous in the middest of the ioynt of the knee, & runneth vp from the legge into the thigh, but is not to be found in all bodies. The fift is thicke & almost round, couering the outside of the knee, and it fastneth together the bones of the thigh, the Brace, and the Legge. The sixt is yet smaller then the fift and softer, and is fastened to the inside from whence it ariseth, running obliquely vnto the forside of the leg.

The Legge also is fastned to the Brace, first by a common Ligament in the vpper part neere the ioynt of the knee which embraceth the connexion of the bones on the outside. Againe in the lower part they are ioyned with a common membranous ligament which proceedeth from the legge vnto the *Brace* which it tyeth thereto.

Moreouer, betwixt the bones of the legge and the *Brace*; the space is occupied or taken vp by a Membranous peculiar Ligament which groweth throughout the length of the Brace very fast vnto it. Notwithstanding his originall seemeth to bee, by the course of his descending oblique fibres, from the leg-bone, and his insertion into the Brace. By this Ligament not onely the bones are conioyned, but also the muscles which occupye the leg are distinguished the forward from the backward, and it also affordeth a strength vnto the originall of these Muscles that grow vnto it.

The Ligaments of the foote are very many, whereof some do containe the tendons transmitted into the foote and the toes, and they are three transuerse, others fasten togither the bones of the foote. Of the Foote.

The first is situated before at the ioynt of the foote with the legge, which fasteneth the bones together and transmitteth some Tendons of the Muscles. The second ariseth from the bone of the legge or from the inward ankle, and is inserted into the bone of the heele, and this Ligament maketh three rings, as it were three Ligaments, because there are three cauities for the tendons of the bending muscle of the greate Toe and of the great bender of the other toes which passe that way. The third ariseth from the outward ankle or from the Brace and is implanted into the heele, it helpeth the Coniunction of the bones, and couereth two cauities to transmit vnder it the Tendons of the two Muscles called *Peronæi*, as we haue shewed before in the History of the muscles.

The vse of these Ligaments as it is in the wrest, is, first of all to add strength to containe the tendons of the muscles of the foote that they be not mooued out of their places: from these Ligaments also those tendons do receiue a portion, by helpe whereof they are produced or lengthned togither with the smal strings of the Nerues. In like maner in the lower side of the toes we finde transuerse Ligaments such as are in the Hand, that containe and establish in their office the tendons of the muscles which bende the second and third ioynts of the fingers. These Ligaments do fasten the bones of the foot, and are referred to the instep, to the wrest, the after-wrest of the foote, and to the Toes. *Platerus* addeth to those, a broade Membrane coupling together many Muscles in the Legge and the Ligament in the soale of the foote, which serueth instead of a tendon. Their vse.

There are also Ligaments which binde the *Talus* or pastorne-bone (for so it is called in Beasts, we call it commonly the Cockall) either to the legge or to the bones of the foote; the first of those that binde the *Talus* vnto the bones of the Legge is common and Membranous and compasseth their articulation, the rest are all gristly. The second ariseth from the inside of the *Talus* where it is receyued by the inner ankle, and is inserted into the Legge bone where it regardeth the *Talus*. The third ariseth from the outside of the *Talus*, and is fastned into the Brace-bone that regardeth the same. Of the Talus.

The Ligaments that fasten the *talus* to the bones of the foote are fiue, the first is common and membranous and compasseth the iuncture of the *talus* with the heele; and this *Vesalius* maketh the fift. The second is stronger and gristly and ariseth from the lower part of the *talus* nere his necke, and is inserted into the heele betwixt the two commissures there-

thereof with the *talus*. This Ligament *Vesalius* accounteth for the third.

The third Ligament, *Vesalius* calleth it the fourth, is gristly likewise, and compasseth the whole ioynt on the outside. It ariseth out of the necke of the *talus*, and is fastned to the bone which is like a Boate. The fourth is strong, arising from the necke of the *talus*, and is implanted into that bone which we call the *Dy* or the *Cube*. The fift is strong and gristly, ioyneth the bone of the Heele vnto the Cube, and encompasseth the ioynt round about.

The Wrest.

The bones of the wrest of the foote are coupled with very hard and gristly Ligaments either among themselues or to the bones that border vpon them. To the Neighbour-bones as on the backside the *Cube* or *Dy-bone* to the necke of the *talus*, and the same vnto the heele, so three bones are fastned to the Boat-bone, and on the foreside to the bones of the After-wrist. They are ioyned one to another as in the vpper part or backe of the foote. In like manner in the lower part there is a very strong and peculiar Ligament, which fasteneth them on the outside and tyeth also the hindparts of the bones together, because it insinuateth it selfe among them.

The After-wrist.

Finally, the Ligaments of the After-wrest and the toes which ioyne them together are answerable to the Ligaments of the hande both in their passage and conformation: those also which run in the distances betweene the bones of the wrest are gristly, the rest are membranous. *Archangelus* addeth, that there are common Ligaments which bind & fasten the particular ioynts of the toes, as it is in the ioynts of the fingers. And thus much concerning Ligaments.

The Third Part of Membranes.

CHAP. XII. *What a Membrane is, their Vses and Differences.*

Definition of a Membrane.

BY the common consent of *Hippocrates*, *Galen* and almost all Physitians ὑμὴν, χιτὼν, μενιγξ, a Membrane and a Coate doe signifie one and the same thing. I knowe there is sometimes some nice difference amongst the Grecians, but it is of no great consequence, & therefore I would haue you to vnderstand me to meane the same thing, when I speake of a Coate and of a Membrane. The definition of a Membrane is much more necessary, which *Laurentius* hath on this manner: *It is a similar part, cold and dry, engendred of the slimy part of the seede, and therefore broad, thin and fast, the organe of the sense of Touching, keeping, knitting and separating the parts vnder it.*

That it is similar it is manifest, because it is vniforme, and though it be wouen with fibres yet are they not conspicuous. I speake here of true Membranes not of membranous bodies, such as are the wombe, the bladder, the stomacke, the guts and such like, which make a part of themselues, and wherein all the three sorts of fibres do appeare. That it is cold and dry, *Galen* teacheth in his Booke *de temperamentis*, but yet it is lesse cold and dry then a Tendon, a Ligament, a Gristle, or a Bone: but more cold and dry then Arteries, Veines and Sinewes. The matter of Membranes is the slimie part of the seede, which by the power of heate is stretched or distended; whence it is that a Membrane may easily be dilated or compressed without danger: onely the Membrane, saith *Galen*, may bee safely distended and contracted, and therefore all parts which were to bee distended and contracted are made membranous. A membrane is broad and extensible to inuest & preserue the part: thight and fast for strength, and beside that it may not so easily receiue an influxion of humors, yet thin, least the waight of it should be offensiue. Notwithstanding though it be thin and appeare simple, yet euery Membrane is double; thorough which duplicature there runne Veines for nourishment, Arteries to conuey life and Nerues to conuey Sense, which vessels being slender and fine, it was fit it should be conueighed betwixt two coats.

The organe of Touching.

The common office of a membrane is to be the organ of the Sense of Touching as the eye is the organ of Seeing, and therefore the sense of a membrane is most exquisite. A Nerue is indeede the conueyer of the spirits and carrieth downe the commandments of the Soule; but as in a muscle it is not the primary organ of motion, as in the eye it receiueth not visible obiects, so it doth not receiue the first tactiue qualities, onely the Membrane is it which we must esteeme the organ of Touching; and if you despoile the partes

of

of their membranes, you make them also insensible. Hence it is that the flesh of the lungs, of the liuer, of the spleene, and of the rest of the bowels is insensible. As therefore the sense of Touching is diffused throughout the whole body of the creature because it is euery where necessary: so likewise are there membranes sprinckled through the whole body almost internally and externally. On the outside the body is inuested with the skinne and the fleshy membrane. On the inside the peculiar membranes are almost infinite.

If it be obiected out of *Galen* in *arte medicinali*, that membranes haue onely inbred not influent faculties such as is sense. We answere with the Reconciler; that *Galen* then speaketh of membranous and broade ligaments which issue from the bones. Obiection.

The three last particles of the definition do elegantly expresse the three principall vses of membranes. They inuest the parts vnder them like a couering, whence they haue the name of coates. They conserue the fibres to make the flesh more firme and stable, they containe the substance of the parts and enclose it round about least it should dissolue and separate part from part. Galen expounded.

Moreouer, they fasten one part to another, from whence proceedeth the admirable simpathy or society of the parts. So by the *periostia* the bones are all continuated one to another; by their common membrane all the muscles are vnited: by the skin the whole body hath his connexion though it be diuers in respect of the structure of parts which are of diuers kindes. The vses of membranes.

Finally, by the helpe of membranes parts are separated from parts, as wee may perceiue in our sections of muscles. There are other peculiar vses of membranes, to sustaine parts as appeareth in the *Mediastinum*: to hinder the refluence of humor as the values that are in the heart, in the great veynes and such like places, and to leade along and establish the vessels that are to be distributed into other parts, as into the mesentery, hekel, & the fleshy membrane.

The differences of membranes are manifold and are taken from their substance, magnitude, site, figure, conformation or texture, and from the nature of the parts which they inuest or containe. If you regard the substance which is the Mansion-house and Ancient seate of the determinate and particular faculty, then wee say that membranes are either lawfull and true or illegitimate. Those are true membranes to which the definition before giuen wil agree, such are the membranes or Meninges of the braine, the *Peritonæum*, the *Pleura*, the *Periostium* and such like; Illegitimate membranes may more truely be called membranous bodies. Of these there are three kindes, some arise from the bones, are broade and insensible, and fasten the ioynts together. Such are called Ligamentall membranes or membranous ligaments. Others are made of the tendons of muscles dilated and so become more like a membrane then a tendon, such are the thin ends of the oblique and transuerse muscles of the *Abdomen*, also the tendon of the muscle that leadeth the leg backward, which they commonly call *fasciam latam* the *broade swath*. To the third kinde I refer those membranous bodies which make parts by themselues, which although they be inuested with coates, yet are altogether made of membranous bodies. Such are the bladders of vrine and gall, the stomacke, the guts, and the wombe, The differences of membranes. The first.

Againe, those membranes which I called legittimate, are eyther of a thin or slender substance like vnto broade cob-webbes, such as appeareth in that membrane or coate of the eie that compasseth the Cristaline humor called *Arachnoides* or the cob-webbe coate; likewise in the *Pia mater* of the braine, and in the coates of the Lungs and the Liuer; or they are thicke as the *Dura mater* and the membrane of the bladder; or they are fleshy as in the face, or altogether neruous.

From the magnitude some membranes are broade and some are long. The figure of membranes is manifolde according to the variety of the parts which they doe inuest. From the situation some are internall some are externall, some supernall some infernall. From the context or conformatiõ some haue fibres of all three kindes, some of two kinds, some of one kind onely: others are without fibres and may be torne euery way as paper may. the second &c

And so much of membranes in generall, of their Nature, vses, aud differences. Now we come vnto their history.

CHAP.

CHAP. XIII. *A briefe enumeration of all the Membranes.*

THE number of Membranes is almost infinite, and we haue handled many of them before as they fell in our way in the order of Dissection, nowe we will gather them into a briefe sum.

The Membranes of the *Embryo.*

The Membranes therefore do some belong to the *Embryo* or infant before it be borne, others to the creature after it is borne also. The Membranes that inuolue the infant are three, called *Chorion*, *Amnios* and *Allantoides*: the *Chorion* is so called, either because it conteyneth the infant, or because it compasseth it like a circle or a crowne: it cleaueth wholly to the wombe by the interposition of the vmbilical veines and arteries. *Amnios* or the *Lamskin* is the receptacle of the sweate. *Alantoides*, so called hecause it is like a Haggas-pudding is onely found in bruite beastes, and couereth the creature not all ouer, but like a broad swath from the end of the breast-bone vnto the hips. Of these we haue spoken more at large in the 5 chap. of the 5 booke, and in the xvi. question of the Controuersies thereto belonging.

Of the Regions.

The Membranes belonging to the creature after it is brought foorth, are vniuersall or particular. The vniuersall we call those which either do inuest the whole body, as the skin and the fleshy membrane: or all the parts of the same kind as the muscles and the bones. The Muscles are all couered with a Membrane which is common to the muscles, thin, neruous and fibrous, which some thinke dooth arise from the *periostium*: but *Bauhine* esteemeth it to take his originall from the sinnewy fibres of the Muscles themselues; and it is fastned to them with thin and slender filaments. The vse of this membrane is to inuest and circumscribe the muscles, to separate them from the other parts and to giue vnto them the sense of Touching. The bones are all cloathed ouer from the crowne of the head to the soale of the foote with a membrane which they call *Periostium*, neruous, thin and very strong, yet we may except the teeth, the inside of the scull, and the ioynts of the Bones: of it we haue spoken in the third chap. of the seuenth booke.

The particular Membranes are such as doe inuest a particular region of the body, or one onely part. The Regions are three, the vpper, the middle, and the lower. The vpper Region is on the outside couered with the *Pericranium*, which is seated betwixt the fleshy membrane and the *Periostium*, arising as some say from the processes of the *dura meninx*, as others from Ligaments which passe through the sutures of the scull, which Ligaments are stretched ouer that part of the scull against which they issue foorth, and so meeting together are vnited into a common Membrane. Of this also wee haue particularly entreated in the place last before named.

The Braine it selfe is couered with two membranes called *Dura* and *pia Mater*: Of which we haue spoken in the 7 chap. of the 7 Booke, and thither referre the Reader for satisfaction, onely heere we remember that they compasse not the Braine only, but his Vicar and substitute the spinall marrow, yea all the nerues throughout their generations.

The Middle Region is inuested round with a membrane which is stretched vppon the ribs, excepting the twelfth and is called *Pleura*: of it we haue spoken in the 6 chap. of the 6 Booke, as also of the purse of the heart and the *Mediastinum* which arise there-from in the seuenth and eight chapters.

In the Lower Belly, the *Peritonæum* comprehendeth or embraceth all the contained parts, and of it we haue spoken at large in the 10 chap. of the second booke.

Of the particular parts.

The particular partes of the body are almost euery one couered with their peculiar membranes or coats. The eies haue six, called *Coniunctiua*, *Cornea*, *Vuea*, *Aranea*, *Ciliaris* and *Reticularis*, of which we haue spoken in the sixt, seuenth, and eight chapters of the 8 Booke. The tongue is inuested and iudgeth of Sapors by a proper coate arising from the third and fourth coniugations of sinewes. The Gullet, the Mouth, the Palat and the Chops are couered with the same coate that couereth the Stomacke; the Heart it selfe, the Lungs, the Liuer, the Guts, the womb, the bladder and all the vessels haue their particular coats: so haue also the Kidnies and that thick, which they call *Fasciam* or the swath-band. The Kell is made of the *Peritonæum* duplicated, so is also the Mesentery. A world of other Membranes there are, which we haue remembred in their particular places, and therefore list not now to trouble either our selues or the Reader with them, seeing they may easily be found by the title of the Chapters in those places to which they belong: we proceed vnto the Fibres, wherein also we will be very short.

CHAP.

The fourth part of the Fibres or Villi.

CHAP. XIIII. *The nature of Fibres*

Fibres are called in Greek ἶνες, in Latine *villi*, although that name is sometimes communicated both to Nerues and to Tendons: some call them κτενόδρας, becauſe they are like the ſtrings or lines in plants, or graynes in the woode. *Laurentius* defineth them to be *Similar partes colde and dry ingendered of the Seede, and therefore white, ſolid and long like fine ſpun threds, deſtinated or appoynted for motion, and to hold the fleſh of the parts, wherein they are, together.* The definition of a fibre.

The firſt particles of the definition are ſo manifeſt as they need no explication, the latter which deſigne their vſe or finall cauſe wee will open in a fewe wordes.

There are two eſpecall vſes of Fibres, Motion and Preſeruation of fleſh. Motion according to the Phyſitians is threefold, Animall, Vitall and Naturall. Their 2. vſes.

Animall or Voluntary Motion is performed by the helpe of the muſcles: a Muſcle is moued when his fibres are either intended or drawne toward their originall, and therefore ſayeth *Galen* in the 8. *de Anatom. adminiſtrat.* if you cut all the fibres ouerthwart, the muſcles would preſently looſe all their motion. Motion three fold.

The Vitall motion belongeth to the Heart and to the Arteries, for the heart hath his fibres manifold and very ſtrong by whoſe helpe he is diſtended, contracted and quieteth himſelfe. The Arteries alſo haue their fibres, in their inner coate many tranſuerſe; in the vtter coate oblique and right.

That Motion we called Naturall is moſt manifeſt in Attraction, Retention and Expulſion. Wherefore all manner of Motions proceede from fibres, but their common action is Contraction.

Notwithſtanding we muſt know that theſe naturall Organs had not their fibres allowed them for a peculiar Traction, Retention and Expulſion, but for a common and officiall. So the Stomach, the Guts, the Veines, the Arteries, the VVomb, the Bladder, the Heart and ſuch like, did not ſtand in neede of fibres for their priuate nouriſhment (for the bones and the brayne, and the griſtles and the fleſh of the bowels doe draw their proper Aliment without fibres) but for a common and officiall action. The heart for the generation of vitall ſpirits; the Arteries for the commoderation or tempering of the natiue heate; the Veines for the tranſmiſsion or tranſportation of bloud; the Stomacke for the making of the *Chylus*; the Guts for the diſtribution of the ſame *Chilus*, and the excretion or euacuation of excrements; the Bladder for miction or making of water; the VVombe for Conception and for the Birth. Fibres neceſſarie for officiall actions.

The other vſe of the Fibres is the cuſtody or preſeruation of the Fleſh, as wel muſculous as that which maketh the proper ſubſtance of the part, for the fibres are as it were the firſt *ſtamina* or the warpe, whoſe empty diſtances the fleſh like the woofe filleth vppe. There are alſo other peculiar vſes of Fibres in the Veines and Arteries, to wit, that therby they might be better extended after all the violent motions of the bloud, and ſo become leſſe ſubiect to miſchiefe. The 2. vſe.

CHAP. XV. *Of the differences of Fibres.*

THE differences of Fibres are to bee taken from their ſite, hardneſſe, ſenſe, texture and from the variety of the Organs. From the ſite they are called Right, Tranſuerſe and Oblique, for if they run lengthwiſe then they are called Right fibres. If they run according to the breadth and interſect or cut the right, then are they called Trāſuerſe or round and circular fibres. If they haue a middle ſituation and interſect both the right and the tranſuerſe at vnequal angles, then are they called Oblique fibres. The office of the right fibres is to draw, the office of the tranſuerſe to expell and that of the oblique to retaine. If the right fibres worke alone then the length of the part is ſhortned and attraction made, if onely the tranſuerſe bee contracted then the latitude or breadth is diminiſhed and expulſion made, but if all the fibres together, the right, the oblique and the tranſuerſe be intended, then the whole part The differences of fibres

is contracted and retention made which also they call *Amplexation*. Retention therfore is made not when any one kind of fiber doth worke, but when all are in action together; for so when we would firmely retaine any thing in our hands we compasse it about on euery side, yet the oblique fibres are said peculiarly to retaine, because when they are contracted they do onely imbrace, for they compasse the part on euery side constringing and closing together the particles thereof: but the right and the transuerse fibres when they are contracted do not only serue for retentiō, but these for expulsion & those for traction.

How Retention is made.

The second difference of fibres may be taken from the hardnes, for some are hard & strong as those of the heart, for the feruent force of the inbred heat did require so much, as also the perpetuall agitation of his necessary motion, others are softer as the fibres of muscles.

The second difference.

The third difference is taken from their sense. Of fibres some are sensible as those which arise from nerues. Others insensible as those that proceede from the ligaments of bones. If you regard the texture of fibres, some are so permixed that they make a continuall body, so true membranes haue their fibres, yea they are nothing else but fibres conioyned one within another. Others are separated from the substance of the part and haue another vse beside the vse of the part, and these are eyther simple as in the muscles (for all the muscles excepting a very few haue but one kind of fibres, eyther right, or transuerse, or oblique) or manifold, and so wouen together that no arte is able to make separation between them.

The third.

The fourth.

So the flesh of the heart is wouen with al 3 kinds of fibres & in the naturall organs which serue for natural motion, if the part haue one proper coat, as a veyne, the womb, the two bladders, then in that coat are al the fibres placed; but if it haue two coats one external the other internal, then are the transuerse fibres placed in the external coat, & the right & oblique in the internal. From this general rule you must except the guts and the arteries, because the guts do serue for distribution and excretion, and the arteries for the expurgation of the heart. Now nature is more carefull for the expulsion of that which is hurtfull then for the traction of that which is profitable.

How the fibres are placed in the Necturall organs.

The last difference.

The last difference of fibres is taken from the variety of Organs, some serue the animall Organs, as the muscles, the nerues, the ligaments, and the tendons: others serue the vitall, as the heart and the arteries: others the naturall, as the Gullet, the Stomacke, the Guts, the Bladders, the wombe, and the veynes. But what euery one of these fibres in their seuerall courses doe performe, and how they are disposed in the parts, we haue declared before in the particular history of euery part.

And thus much concerning the fibres: Now we proceede vnto our last taske of the Bones.

The end of the Twelfth Booke.

THE THIRTENTH BOOKE,
Of the Bones.

The Præface.

A Ship that hath bene long at Sea, diſcouered many ſtrange Continents and Riuers, ſtrugled through many hiddeous tempeſts, eſcaped many Rockes and Quicke-ſands; though ſhe hath made no rich Returne, yet when ſhe commeth within ken of her owne Countrey, and ſees the Land lye faire before her: If thou canſt imagine (Gentle Reader) how ſodainly ſhe forgetteth her irkeſome Trauell, thinke alſo how well apaid I am, that I am come within view of the end of this my Tedious Voyage. For I alſo haue trauelled about a *Worlde*, and that for thy behoofe.

In my Iourney, if I haue not made many new Diſcoueries; yet certainely I haue ſounded the Depths more truely, Entered farther into the Continents, Coaſted the Shores, plyed vp the Frythes, Diſcouered the Inhabitants, their Qualities, Tempers, Regiment of Life, their Diet, their Apparrell, their Imployments: And in a worde, I haue made it eaſie for thee to reape the profit of many mens Labors, and of mine Owne. Yet thou muſt Vnderſtand this but as a Letter of Aduertiſement from the Coaſt. I haue not yet brought my Barke about: Many haue ſhunned *Scylla* and *Charibdis*, and haue miſcarried euen in the Mouth of the Hauen, where there are more Rockes then in the Maine; Many Reaches, which we muſt haue diuers windes to fetch, and therefore thou muſt haue Patience if wee make not ſo freſh a Way, but bee conſtrained to winde in by Bourds; and in the meane time, forget not Thou to follow vs with thy Vowes. For this Shore is buttreſt with Rockes on euery hand, the Currants ſwift, the Shallowes many. To breake off our *Metaphor*. The Hiſtory of the Bones is a buſie piece of Worke; their Articulations and Compoſitions many diſſolute and laxe, many ſtrict and cloſe; Their Coalitions hard to be diſcerned, harder to be expreſſed; Their Perforations, Cauities, Boſomes, Appendancies, Prominences and Proceſſes, difficult to diſtinguiſh. Now therefore, if at any time, I ſtand in neede of thy patience; (Gentle Reader) for my Stile heere muſt be abrupt and broken, hard and harſh of neceſsity according to my Argument. If thou canſt finde Profit, loooke not for Pleaſure; and if thou finde it hard to Reape in this vnequall Field, remember hee had ſomething to do that brake vp the Swarth, and ſowed it for thee.

CHAP. I. *Of the definition and differences of Bones.*

THE Bones saith *Hipocrates* τῷ σώματι παρέχουσιν ἡ ὀρθότητα καὶ εἶδος παρέχονται, that is, *doe giue to the whole body Stability, rectitude and forme*: for they are as it were the carkasse of a Shippe whereto the rest of the parts are fastned, whereuppon they are sustayned and the whole mountenance of the body is built and consummated. From their figure and magnitude we esteeme of the figure and magnitude of the rest of the parts: without the knowledge of the bones we must needes bee ignorant of the originals and insertions of Muscles, of the courses of the Veines, of the distribution of the Arteries and of the partitions of the Nerues. The vniuersall *syntax* or composition of the Bones from the Head to the Feete the ancient Grecians called σκελετὸν ἀπὸ τοῦ σκελεῖν, as it were a dryed or arrid carkasse.

The knowledge of the bone necessary,

Galens definitions.

Galen defineth the Bones to be *the hardest, the dryest & most terrestriall part of the creature.* But this definition doth not please the pallats of the new writers, as being not exquisite or Philosophicall, but made onely for the ruder and more ignorant sort by way of innitiation. *Laurentius* defineth them more accurately thus.

Laurentius definition.

A Bone is a similar part, the dryest and coldest of all the rest, made of the earthy crassament and fatnesse of the seede by the formatiue faculty, assisted by the strength of heate, for the stability, rectitude and figure of the whole body.

The explications thereof

And this definition he sayth is Essentiall, because it designeth all the causes of Bones, the Efficient, the Materiall, the Formall and the Finall. The forme of similar partes according to Physitians is the Temper, because it is the first *Power* whereby and wherewith the forme worketh and suffereth whatsoeuer the similar part woorketh as a similar. *Siccity*, therefore and *Frigidity* dryeth and coldnes doe expresse the forme of a bone. It is drye because of the exhaustion of moysture and fatnes, made by an intense or high heate. Cold it is because the heate vanisheth away for defect of moysture. These primary qualities are accompanied with secondary, hardnes, heauines and whitenes. A Bone is hard not by concretion as yce, for then it would be dissolued by the fire, not by tention as the head of a drum, but by siccity as wood.

The forme.

Heauy it is because it is earthy, as also because the aire and the water in it are extreamly densated and thickned: and it is white because it is spermaticall.

The matter.

The matter of the Bones is the crassament of the seed, that is, the thicker and more earthy part. *Aristotle* cals it *Seminale excrementum*, the excrement of the Seede. For though the Seede seeme to bee *Homogeny*, yet it hath some parts thicker then others. There is in it also something fat and something glutinous or slimy. Of the glutinous part because it may best be extended or streatched, are made the nerues, membranes and the ligaments. Of the fatty part are made the bones, and this *Hippocrates* confirmeth where he sayth, *Where there is more fat then glew or slime, there the bones are formed.*

The efficient.

The Efficient cause of a bone is the Formatiue power which some call the Idoll or the *Idea* of him that ingendreth: this faculty vseth the heat for his architect, and the spirit for his chiefe worke-man, and to these the Philosopher attributeth Ordination, Secretion, Concretion, Densation and Rarification. The heate therefore drinketh vp and dryeth the fatnes, whence comes hardnes and solidity. So saith *Hippocrates*, *Bones are condensated by heat and so grow hard and dry.*

Futhermore this heate although it be moderate (for the substance of our natiue heat is well tempered,) yet because it maketh a longer stay in a more dense and fast matter, it bringeth forth the same effects that an intense or high heat doth; yea it seemeth to burn, whereupon *Hippocrates* doubted not to say, *that the generation of bones was made by exustion, that is, by burning.*

The end.

The finall cause of Bones which *Galen* is wont to call their vse, is well expressed in the last particle of the definition. For the primary and most common vse of bones is to giue the body stability, rectiude and figure. Stability because they are as it were propugnacles or defences against all violence, beside they sustaine the body as the bases or finials of a house sustaine the roofe. Rectitude because without bones the creature cannot stand vpright but would creepe vpon the ground as a Serpent or a worme. *Hippocrates secundo Epide-*

Stability.

Rectitude.

Epidemion, maketh mention of a childe borne without bones, yet were the principal parts of his body separated and fashioned, but he was not aboue foure fingers big, and dyed soone after he was borne.

Finally, the bones do giue the figure to the body, because from them dependeth the procerity or stature and the limitation of the growth. For those that haue a great head haue large braines, those that are narrow chested their Lungs also and bowels are but short and narrow: those that haue small iawes haue also small muscles. By reason of this finall cause, which being it selfe immoueable mooueth all the rest, the bones are of that substance which we see, hard, solid, and insensible: hard and solid for so it behooued a pillar or prop to be; insensible *ad ἀνωδυνίαν*, that they should not bee so apprehensiue of payne, for because they sustaine the burthen of the body and are continually moued, they could not haue endured so diuers motions without paine if they had beene sensible thereof, and then the life of the creature should haue beene alwayes sad and querulous. But this want of sense comes not from their earthly substance; for then the teeth which are the hardest of all bones should haue no sense; but because there are no nerues dissemina-ted through their substance. Why bones are insensible.

The differences of Bones are to be taken sayth *Galen* as also the differences of singular parts *from those things which follow the essence, or happen thereto.* The differences of bones.

The essence of a bone, that is, his cold and dry temper doe the Tactile qualities follow, Hardnesse, Softnesse, Density, and Rarity; the accidents are Magnitude, Figure, Situation, Motion, Sense, and the like.

The first diuision therefore of bones is from their hardnesse. Some bones are very hard as those that are called Stony bones and the Teeth; others soft in respect, as the spongy bones and those which we call *Appendices* or *Appendants*; others are simply hard as all the rest. From the hardnesse.

From the magnitude some bones are great, some little, and some moderate. There are among the Anatomists that account those bones to be great which are of a large bore or very hollow and medullous or marrowy. But wee make account of such bones for great as are great in quantity, whether their marrow be lesse or more, for the hanch-bones and the shoulder-blades which are not hollow nor medullous are yet great bones. But because the quantity belongeth to Dimentions and Dimention is three-fold, long, broad and deepe, therefore from the magnitude of bones may be taken a three-fold diuision of them. For some are long as the thigh bone, others are short as the bones of the fingers: some are broad as the shoulder-blade and hanch-bones: others narrow, some crasse or thick, others fine or thinne. Magnitude.

From the figure some bones are plaine, some round, some haue three sides, some haue foure, some are like a boat, some like a Cube or Dye, some like a Mallet, or an anuill, or a stirrop, &c. Figure.

To the figure also we referre, as the best Physitians doe, the passages and cauities, the smoothnes or roughnesse. Some therefore are solid others not solid: some smoothe and some rough; I call that solid which is not hollow. Solid bones therefore doe eyther appeare altogether solid hauing no cauities or dens in thē, or at least none sensible as the bones of the eares and the nose; or else they appeare solid on the outside, but within are full of perforations and holes like sponge as are the bodies of the rackbones. To solid bones we oppose those that are hollow, that is, such as haue a sensible or conspicuous cauity, which *Galen* calleth κοιλία, a belly.

In these is that substance contained which we properly call marrow, in latine *Medulla*, and therefore such bones we say are medullous, that is marrowy bones.

From the situation there may a twofold difference of bones be taken, because vnder the name of situation we comprehend the position and the connexion. Site.

If you respect their position, some are vpper others are lower, some on the fore-side others on the hindside, &c.

If their connexion with other parts, some are fastened by muscles, some by ligaments, and some by gristles. From motion some bones are mooued as those that are articulated by *Diarthrosis*; some are immooueable, as those that are fastened by *Synarthrosis*. Motion.

From Sense, some bones are sensible as the Teeth, all the rest without sense. Sense.

Finally, we will adde that difference of bones which is taken from the order of generation. For some bones are generated perfect and compleate as the small bones of the eares, the ribs, and the cannell or coller bones. The bones of the eares, because it was fitte they should be very hard and very dry the better to resound. The ribs because they were to make the cauity of the chest wherein the heart was to moue from the very birth. The coller bones because they tye the armes to the body e and strengthen the breast. Other bones are at the first imperfect or little differing from Gristles, as the bones of the Heade and many in the body beside.

And thus much of the differences of bones; now we proceede vnto their parts.

CHAP. II. *The particular parts of bones and an exposition of many appellations or names, of which we shall haue frequent vse in the History of the Bones.*

Three parts of a bone.

IN Bones two things are to be considered; their parts and their cauities. The parts of a bone are three-fold; the principall part whereof the bone consisteth; the parte that groweth to the bone, or the bunching part of the bone. The principall part of the bone hath no proper name belonging thereto, but is called by the name of the whole bone. The part that groweth to the bone is properly called *Epiphysis*. That part which bun-

The principal

cheth or beareth out beyond the plaine surface is called *Apophysis*. The principall part is the primary bone made by Nature, as a man should say, at the first hand or according to Natures first intention. This is the basis of the rest and occupieth the middle place as being the hardest part; for it is in the generation of bones as in the structure of the vniuerse that which is hard and earthy is placed in the Center.

To this principall part often times groweth another which the *Græcians* call ἐπίφυσις, the *Latines* Appendix, we may call it an Additament, or if you will we may retaine the

The appendix

Latine word Appendix, because it is growne in vse amongst vs. For as if Nature had forgotten her selfe & made the bone too short, she eeketh it out by this Appendix as workmen vse to lay stones or timber vnder their postes or pillars to lengthen them when they are too short. This appendix *Hippocrates* often calleth περόνην, which wee note but by the way.

An appendix therefore is a bone by it selfe, fastened to the whole bone by Symphysis or Coalition; not the vnition it selfe of one bone with another, for so there should be no difference betwixt *Symphysis* and *Epiphysis*, *Coalition* and the *Appendix*. That it is a bone by it selfe is manifest because it hath a proper and peculiar circumscription, and in young creatures may easily be separated without coction or putrifaction; yea it hath often been obserued that in young children it hath beene luxed, if I may so say, by a blow or by a fall and separated from his bone. This Appendix is fastened to the principall bone by that kinde of *Symphysis* or *Coalition* which is made without a *Meane*, because the extremities or ends of the primary bone are softer then their middle parts. Now the substance of an Appendix is rare and lax: but saith *Aristotle*, *Soft things are easily contained in the termination of another, and yeelde vnto them.* This *Coalition* is not made by a plaine superficies or

Their Coalition.

surface but by a mutuall ingresse of a head and a Sinus or bosome, which kind of coniunction doth much resemble that which afterward we shall call *Ginglymos*.

The substance of an Appendix is rare and lax, at first gristly, but in processe of time it

Their substance.

groweth harder and drier because in the motion of the ioynts and their attrition the heat is stirred vppe which drieth and hardneth it. To the extremity of the Appendix Nature hath added a gristle that they might not be so subiect to outward iniuries, or if they happen to be broken yet the softnes of the gristle may helpe them to reunite againe. In old bodies they are so vnited with the principall part of the bone that they can very hardly be separated, yea they seeme to be very parts of their bones. All bones haue not this Appendix, for in the lower iaw there is none. In some bones there is but one, as in the rootes of the ribs and in childrens teeth: in others it is double one at eyther end, as in the Legge, the Brace, the arme, the Ell and the Wand. In others it is treble, as in the haunch-bone; some haue foure as the bone of the thigh, three in the vpper part and one in the lower. The *vertebræ* or rack bones haue fiue, two in the transuerse processes, two in the bodies, and one in the Spine. There are many Appendices which are ordinarily by the people taken for processes, as the tooth of the second Rack-bone, the great Trochanter, Styloides, &c.

The

The vſes of theſe *Appendices* or Appendances are diuers, *Galen* acknowledgeth a double vſe: one that in Bones which haue marrow they ſhould ſerue in ſteade of a couer to keepe the marrow in, for that which is hollow and ſolid as is the lower iaw, doth keep in his marrow without an Appendix. Their vſes;

The other for more firme articulation, for a bone is better eſtabliſhed vpon a large Baſis, whereas if the bones ſhould determine into a ſharper poynte, their conſtruction or articulation would bee more dangerous and deceitfull, and the bones eaſily and vppon a light offence would fall out of their ſeates. And herein Art immitateth Nature, for the Baſis or foote of a Finiall or columne for more ſecurity is made large and broad. But becauſe theſe Appendances are broade, Nature made them rare and laxe, leaſt their wayght ſhould preſſe too much vpon the parts vnder them.

To theſe vſes of *Galen* we may alſo adde others, firſt that out of them the Ligaments might take their originall, which either faſten the bones or make the tendons or chordes of muſcles. *Falopius* obſerued that the Ligaments were not extended or lengthned beyond the appendices, as if the appendix bee ſhort the Ligament is alſo ſhort.

Moreouer, the Appendix being ſofter then the bone and harder then the Ligament, interpoſeth it ſelfe as a mediator betwixt the coniũction of the bones, for ſuch is Natures vſe to couple things that are extreame by thoſe that are in a meane.

Adde hereto, that by the interpoſition of the Appendices the fracture of a bone, if it happen, is ſtayed and goeth no further, as appeareth in the ſutures of the head.

Againe, Appendices were made for the conſeruation of the ioynt. For a bone being very hard, if one hard thing ſhould haue beene committed or conioyned to another, by reaſon of their continuall motion they would haue beene broken or at leaſt worne as the teeth are, and therefore the bones were conſtrued or conioyned by ſofter bodies.

Some out of *Hippocrates* doe imagine that the Appendix was made to bee as it were the belly of the bone wherein his Aliment is concocted, from whence by degrees it is percolated or ſtrayned into his ſpongy or hollow parts. And thus much of the ſecond part of a bone.

The third part of a bone the Grecians call ἀπόφυσιν, the Latines *Proceſſum*, many other appellations it hath in Greeke and Latin, but wee take the moſt common. In Engliſh we call it a *Protuberation* or *Proceſſe*, and may be deſcribed thus: A proceſſe is a legitimate part of the bone, breaking out of the bone it ſelfe, and bunching beyond his plaine and euen ſurface: ſuch as are the knags of Harts-hornes. Euery bone almoſt hath his proceſſes, but they are moſt conſpicuous in the lower Iaw and in the racke-bones. A proceſſe.

Their vſe we acknowledge to be double: one for the originals and implantations of many parts, eſpecially of muſcles; for vnleſſe the bones had protuberations or productions in them, neither muſcles nor ligaments could grow from them. Another vſe of theſe proceſſes is, that in ſome parts they ſhould ſupply the place of a defence as it is in the rack bones and in the ſhoulder-blades. Their vſes.

The differences of Appendices and Proceſſes are taken from their Figure. For if the protuberation be round it is called a *Head*, whether it be an appendix or a proceſſe. If from a narrow beginning it be by degrees dilated it is called a *Necke*. If it end in a cone or an acute termination it is called κορώνη. An Appendix therfore or a Proceſſe is threefould according to the variety of their figure, a *Head*, a *Necke* and a *Point*. How they differ from appendices.

The *Head* is double, one which is abſolutely called a Head, long and large, ſuch as is the head of the Thigh-bone: the other depreſſed which is commonly called κόνδυλον, wee may properly Engliſh it a Knuckle. The head.

The *Necke* is only of one ſort, herein differing from the head, that for the moſt part the head is an appendix and the necke a proceſſe. The necke.

That which is called κορώνη the *Cone* or Poynt, an acute or ſharpe proceſſe is manifould. One is like a *Bodkin*, another like an *Anchor*, another like a *Crowes-beake*, and another like the nipple of the *Dugges*. The poynt.

The firſt is called *Styloeides* or *Graphoeides*; the ſecond *Anchyroeides*, the third *Coracoeides*, and the fourth *Maſtoides*.

Thoſe proceſſes which at the circumference of the cauities doe hang out like lippes and increaſe the depth of the *Cup* are called *Browes* or *Lips* or *Verges* or *Brimmes* or what you liſt, for all theſe things they doe reſemble. And theſe are the parts of a bone in generall.

The

Differences of cauities.

The ſecond thing to be conſidered in a Bone was the cauity, which was made for the articulation or conſtruction thereof. Of cauities there are two ſortes; ſome are deepe and ſome are ſhallow. The deepe cauities which haue high and large browes about them are called κοτύλη a *Cuppe*, and indeed it is moſt like the new faſhioned ſiluer bowles which are rounde and deepe, and the edges hanging ouer their cauities: ſuch are found in the hanch-bone and in the ſhoulder-blade The ſuperficiary or ſhallow cauities are called γλῆναι from the cauity of the eye when the liddes are ſhut: and they are ſo obſcure that at the firſt ſight you may doubt whether they admit another bone or themſelues enter into another: Theſe cauities whether they bee deepe or ſhallow, *Hippocrates* calleth βαθμίδας. And theſe are the Appellations and names which we thought good in this place particularly to explayne, becauſe in the Hiſtory of the Bones you ſhall meete with very frequent mention of them. Now we proceede vnto the ſtructure and connexion of bones.

CHAP. III. *Of the ſtructure and connexion of Bones in Generall.*

Why mans body was not made of one bone.

MAn being created for Vnderſtanding and Action, to receiue infinite images of Senſible things, and to flye or apply himſelfe to the diuers obiects of his appetite, ſtoode in neede of locall motion, but if hee had beene made of one continuall bone, how could he haue bent or extended or compaſſed his body? how could he haue apprehended any thing or moued himſelfe forward to attayne it? No; he muſt haue ſtood like a trunke or a blocke, and the creature that was made to commaund all the reſt would haue beene a right Mauchen or gazing ſtocke to the reſt. Nature therefore for the better accompliſhment of the varieties of motions, hath wonderfully framed the body of man of a Packe or Set of bones, of diuers kinds and manifold figures. And this diuerſity is alſo of as great conſequence *ad ſuſtentationem*, that when one bone is broken the fracture might ſtop and not offend the reſt. Hereby alſo is there fit way made for Tranſpiration of fumid vapours: hereby are the parts diſcriminated or diſtinguiſhed one from another: hereby is the ingreſſe aud egreſſe made for the veſſels. Notwithſtanding though this connexion bee diuers, yet is it ſo ſtrangely fitted together that al ſeeme to be but one: one I ſay either by Continuity or by Contiguity at leaſt. The vniuerſall compage of coagimentation of the bones is called a *Syntax*, and the packe of bones ſo fitted together is called a *Sceleton*.

What a *Sceleton is.*

The manner of this *Syntax* or compoſition is double, for it is made either by *Articulation* or by *Coalition*. *Articulation* we define to be a Naturall ſtructure of the bones, where in the extremities or ends of two bones do touch one another. So that the whole Nature of *Articulation* conſiſteth in the Contaction of extremities or ends. This Articulation according to *Galen* is double; one laxe and looſe called *Diarthroſis*, for διὰ in compoſition of wordes ſignifieth a ſeparation or looſenes; another ſtrict and ſo compacted that there is no ſpace left for motion. And this kinde is called *Synarthroſis*. The firſt is with manifeſt motion; the ſecond hath no motion at all, or if it haue any it is ſcarcely conſpicuous.

Diarthroſis. *Enarthrosis.* *Arthrodia.*

Of *Diarthroſis* there are three kindes, *Enarthroſis*, *Arthrodia* and *Ginglymos*. *Enarthroſis* is when the cauity that receiueth is deepe, and the head inſerted into it long, and ſuch is the articulation of the Thigh-bone with the Haunch. *Arthrodia* is when the cauity is ſuperficiary or ſhallow, and the head depreſſed or almoſt playne; and ſuch is the articulation of the lower iaw with the Temple-bone and the Nowle-bone with the firſt ſpondell.

Ginglymos.

Ginglymos is when the ſame bone receiueth & is receiued, as it is in the hindges of a dore, wherein the yron that carrieth the hindge and the hindge that is carried doe mutually enter one into another.

In *Ginglymos* therefore the gibbous part of one bone entreth into the hollowneſſe of another; and againe the *Sinus* or boſome of one bone admitteth the gibbous or embowed part of another.

This *Ginglymos* is made two wayes; for either the ſame bone is receiued by one and receiueth it againe, or it receiueth one bone and is receiued of another.

An example of the firſt wee haue betwixt the Arme and the Cubit: of the ſecond in the Racke-bones of the Backe, for the *vertebra* in the middeſt receiueth that ſpondell which is aboue it, and is receiued by that which is vnder it.

Synarthrosis 3.

Of *Synarthroſis* there are alſo three kinds, *Rhaphe*, *Harmonia*, and *Gomphoſis*. *Rhaphe*, the

the Latines call *Sutura* a seame, for it is like the seame of a garment: and it is double, one toothed like a Saw or a combe, the other plaine like the scales of a fish or the mayles of a Harnesse, or nailes of the fingers one thrust vnder another. The first we find in the sutures of the scull, the second in the Temple-bones. *Harmonia* is an articulation by a simple line, either right, oblique or circular, and so are almost all the bones of the vpper iaw ioyned together. *Gomphysis* is when one bone is fastened into another, as a naile into a boord, and so the teeth are set in the iawes. And these are the two kinds of articulation, *Diarthrosis* and *Synarthrosis*, vnto which we may add out of *Galens* twelfth chapter of his Booke *de ossibus* a third which is a neutrall articulation halting betwixt two, and participating of them both, yet being neither perfectly: and this neutrall articulation, because the motion thereof is obscure, may bee saide to belong to *Synarthrosis*, but in respect of the manner of his composition which is made by a cauity and a head, it may bee called *Diarthrosis*. Such is the articulation of the ribs with the breast-bone and the rackes: such also is seene in the wrest and the insteppe. And these are the differences and kinds of articulation.

Synarthrosis 3. Kinds.

The Neutrall Articulation.

The other kinde of composition is called *Symphysis* or *Coalition*. For Nature well fore-seeing that the articulation of great bones was not very secure, because they might easily slip out of their seats, she therefore deuised a more streight or neere kinde of coniunction or colligation which Anatomists do call *Symphysis*, wee coalition, which is nothing else but a naturall vnion of bones, by which two bones are continued together and made one, so that the nature of coalition consisteth in continuity, as the nature of Articulation did in contiguity or contaction of extremities.

This *Symphysis* or coalition is double, one with a meane, another without a mean. Those bones that are soft and fungous do grow together without a *Meane*, so all appendancies almost because they are soft and gristly are vnited with bones by coalition, but those that are dry and hard cannot be vnited without the inter-vening of another bodye. That middle body is threefold, a nerue, a gristle and flesh. And hence proceede the three differences of *Coalition*, *Synchondrosis*, *Synneurosis* and *Synsarcosis*. An example of *Sychondrosis* wee haue in the share-bones, and in the lower iaw. An example of *Synneurosis* in euerie *Diarthrosis*, but you must vnderstand that by a Nerue in this place we meane a Ligament. An example of *Synsarcosis* you haue in the bone *Hyois* and in the shoulder-blades, but by flesh here we vnderstand muscles. VVee haue heere added a Table which containeth their pedigree, wherto we wil not so exactly stand, as that there may be no exception taken thereto bycurious Schollers, either in the manner of diuision or in the Appellations, although presume such as will be most ready to find fault, will not finde it so easie to Amend.

The Table of Connexions.

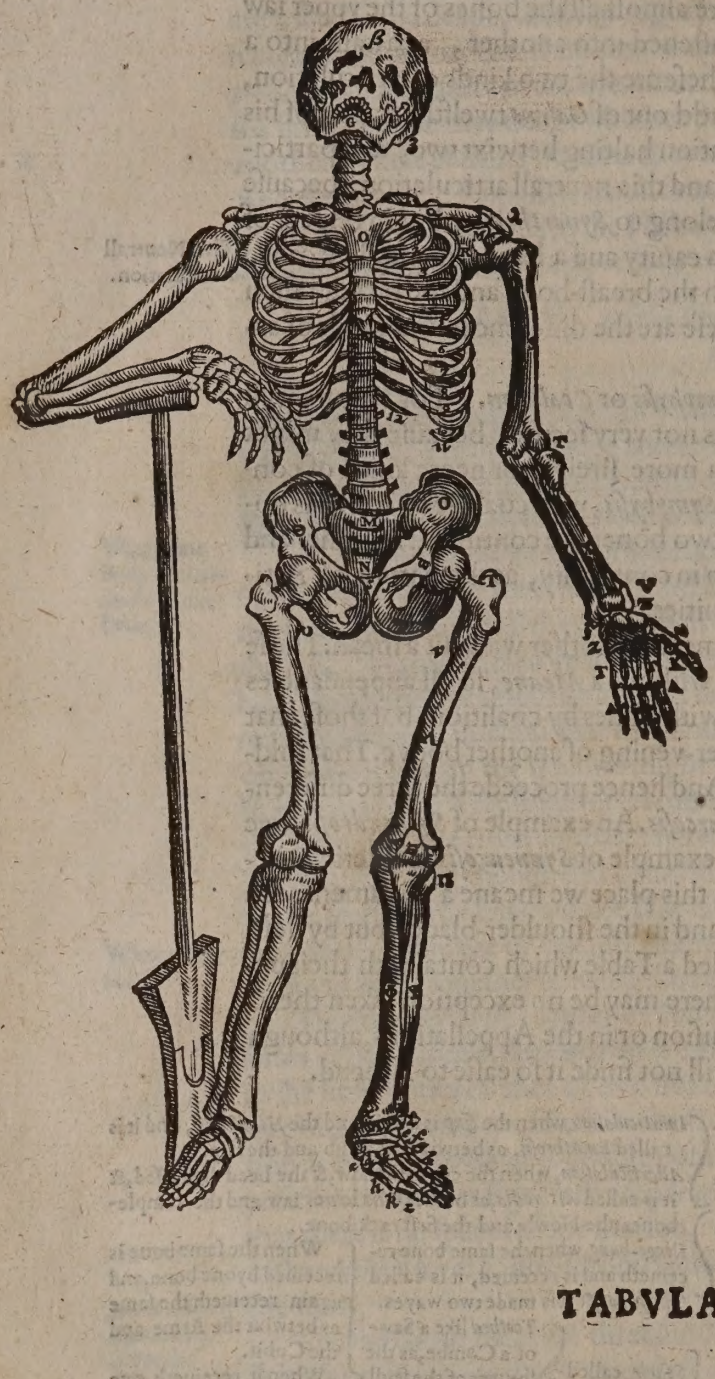
Bones are ioyned or compounded by

- *Articulation*, whose Nature consisteth in contiguity of extremities, & it is threefolde.
  - *Dearticulation* which is a laxe and loose iuncture, called *Diarthrosis*, and is of three sorts
    - *Inarticulation*, when the *Cup* is deepe, and the *Head* long, and it is called *Enarthrosis*, as betwixt the thigh and the Hip.
    - *Adarticulation*, when the cup is shallow, & the head depressed, & it is called *Arthrodia*, as betwixt the lower iaw and the temple-bones, the Nowle and the first rack-bone.
    - *Hinge-hung*, when the same bone receiueth and is receiued, it is called *Ginglymos*, & it is made two wayes.
      - When the same bone is receiued byone bone, and again receiueth the same as betwixt the Arme and the Cubit.
      - When it receiueth one bone & is receiued of another, as a midle rackbõe receiueth the vpper & is receiued of the lower.
  - *Coarticulation* which is a strict and well compounded iuncture, and it is called *Synarthrosis*, it is also of three sorts by
    - *Seame* called *sutura*, and it is double.
      - *Toothed* like a Sawe or a Combe, as the sutures of the seull.
      - *Plain* like the scales of a fish as the temple bones with the scull
    - *Harmony* which is like to Cæmentation made by a line which is
      - Right,
      - Oblique.
      - Circular.

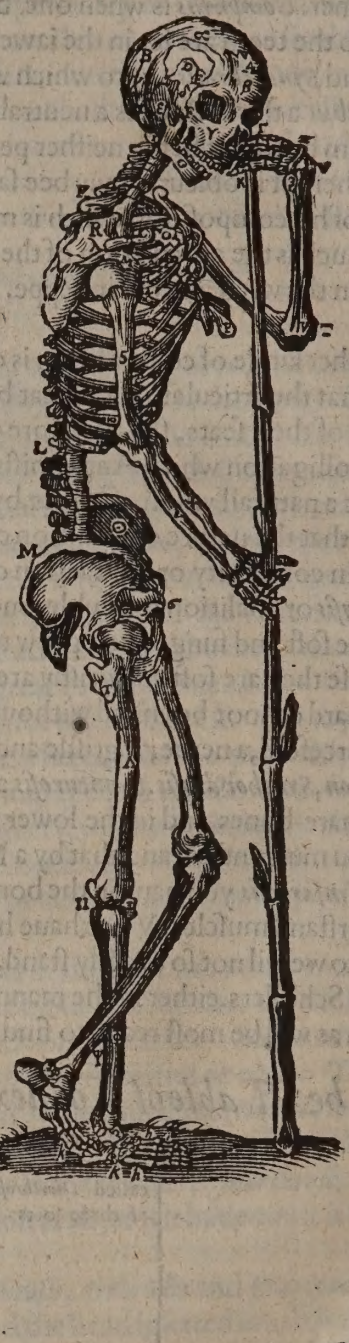
      So almost are all he bones of the vpper iaw articulated.
    - *Mortize*, which is when one bone enters into another, as a Tenant into a mortize, so the teeth are fastned in the iawes, and this is called *Gomphysis*.
    - *Galen* addes a thirde which is newtrall or doubtfull; and is neither the one nor the other, but partaketh of them both, agreeing to *Coarticulation* by reason of the obscurity of the motion, and to *Dearticulation* if you regard the composition of the heads and the cauities. Such is the articulation of the ribs with the breast bone and the racke-bones, and that of the bones of the wrest and the Instep.
- *Coalition* or vnion, whose Nature consisteth in continuity, and it is cald *Symphysis*. It is double.
  - Without a Medium or Meane, so do soft and fungeous bodies grow together, as almost all Appendancies.
  - With a Mean, as dry and hard bones which are not vnited w thout the interposition of some middle body: and that is
    - A Gristle such Coalition is cald *Sychondrosis* and it is found betweene the share-bones.
    - A Ligament called *Synneurosis*, and it is found in all Dearticulations
    - Flesh called *Synsarcosis*, and is found in the bone *Hyois* and in the shoulder-blades.

To this place also we haue thought good to add six seuerall Tables conteining the Sceleton or packe of Bones throughout the whole bhdy, as they appeare before, behinde, & on the side in a man; the Sceleton of a woman; of an infant newe borne, and of two vntimely Births, with their descriptions at large, by which the Reader may be well initiated before he come to the particular Historie.

TABVLA I.



TABVLA. III.



TABVLA. II.

Ta 1. *sheweth the forpart of the sceleton of a man, that is to say, the whole packe of the Bones and Gristles in a mans body, as they appeare on the foreside.*

Table 2. *sheweth the backside of the Sceleton.*

Table 3. *sheweth the laterall part of the Sceleton. Wherefore we will put all these three descriptions into one.*

A 3. The Coronall Suture called in Greeke στεφανιαῖα.
B 2 3. The suture like the letter A called λαμδοειδῆ.
C 2. The sagittall suture called ὀβελιαίζα.
D 2,3. The Scale-like *Coniunctiõ*, cald λεπιδοειδεῖς
α, 2,3. *Os verticis* or *syncipitis* the bone of the *Sinciput*, called *Os* βρέγμαλος.
β, 1. 3 The forehead bone, that is, μετώπη.
γ, 2,3. The bone of the Nowle or ἰνίς.
δ, 2,3. The bones of the temples or κροταφῶν.
ε 3. An Appendix in the temple-bone like a Bodkin, συλοειδὴς.
ζ, 1,2,3. A processe in the temple-bone like the teate of a dugge, called therefore *Mamillaris* and μαστοειδὴς.
E 2,3, the wedge-bone, σφηνοειδὲς.
η, 3, the stony part of the scull.
θ 3, A processe of the Wedg-bone, much like the wing of a bat, and therfore called πτερυγοειδεῖς
F, 1,2,3. The yoke-bone ζυγῶμα.
G. 1,2,3, the lower iaw.
I K, L, M, N, 1,2,3. the backe or the spine, ῥαχὶς.
From I to K, the Necke, τράχηλος.
From K to L, the rackebones of the Chest.
From L to M, the rackebones of the Loynes.
From M to *N*, the Holy-bone, ἱερὸν.
N, the Rumpe bone, κόκκυξ.
O 1,3, the brestbone στέρνον.
P, 1,3. the Sword-like gristle of the brest ξιφοειδὴς
Char. 1,2,3, as farre as to 12 in all three Tables, shew the twelue ribs of the Chest, cald πλευραί.
Q 1, the Clauicles or choller bones κλεῖδες.
R, 1,2,3, the shoulderblade, ὠμοπλάτης.
λ, 1,2 3. the vpper processe of the shoulderblade, or the top of the shoulder, called ἀκρώμιον.
μ, 3,3, The lower processe of the shoulderblade, called ἀγκυροειδὴς.
S, 1,2, the bone of the arme, called *Humerus* and βραχίων.
T, V, 1,2,3, the Cubit πῆχυς.
X, 1,2,3. the wand or the vpper bone of the cubit called κερκὶς.
Y, 1,2.,3 the ell or the lower bone of the Cubite, called πῆχυς.
ν 3, the processe of the cubit, ὠλίκρανον.
ξ, 1,3, the processe like a bodkin or probe, called συλοειδὴς.
ZZ, 1 2,3, The wrest καρπὸς.
ΓΓ 1,3, The Afterwrest κελεκάρπιον.
ΔΔΔ, 1, the fingers δάκτυλοι.
Θ, 1,2,3. The bones ioyned to the sides of the holy bone on each side one, distinguished as it were into three parts.
ο 1,2,3. the first part called the Haunch bone *Os Ilium* λαγόνων.
π, 1,2,3, The second part the bone of the *coxendix* ἰσχίον
ρ. 1 ,2,3. The third part, the sharebone *os pubis*, ἤβης.
σ, 1,2,3. A gristle going between the coniunction of the share bones.
Λ, 1,2,3, the thigh, μηρὸν.
τ, 1,2,3, the greater outward processe of the thigh called *Rotator*, τροχαντὴρ μέγας.
υ, 1,2.3, His lesser and inner processe.
Ξ, 1,2,3. The whirlebone of the knee *Patella Rotula*, ἐπιμυλὶς.
Π, Σ. 1,2,3, The leg, κνήμη.
Φ, 1,2,3, the inner and greater bone of the legge, προκνήμιον.
Ψ, 1,2,3, the vtter and smaller bone of the Legge called the *Brace-bone*, *Fibula* περόνη.
φ, 1,2,3. The processe of the Legge or the inner Anckle called *Maleolus internus*.
X, 1,2 The processe of the brace or the outwarde ankle, both of them are called in greeke σφυδὼν
Ω, 1,2,3, the bone called the cockal *Talus*, *balista*, *Os* ἀστράγαλος.
a, 2, The Heele *Calx*, πτέρνα.
b 1,3, The bone called *Os Naviculare*, σκαφοειδὲς.
cc, 1.2,3. The wrest of the foote called *Tarsus*, consisting of foure bones, ταρσὸς.
d, e, f, 1,2.3, Three inner bones of the wrest of the foote, called by some χαλκοειδῆ.
g, 1,2,3. The vtter bone of the wrest of the foote, like a Dye, κυβοειδὲς.
kh, 1,2.3, The Afterwrest of the foote called *Pedium*, by some μετάταρσος.
i, i, 1,2,3. The toes of the foote.
k, 1,2,3. The seed bones of the foote, called *ossicula sesamina*, σησαμοειδῆ.

FIG. III.

Table 4 sheweth the Sceleton of the bones and gristles of a woman, that it may appeare, all her bones are in proportion lesser then the bones of a man. But in this table onely those parts are marked with letters wherein a woman differeth from a man in her bones & gristles

TABVLA IIII.

A, The sagittall suture descending vnto the Nose and diuiding the forehead bone, which is sometimes found in women, very rarely in men, but alwayes in Infants.

BB, the chest somwhat depressed before becaus of the Paps.

CC, the coller bones not so much crooked as in men, nor intorted so much vpward.

D, the brest-bone perforated somtimes with a hole much like the forme of a heart, through which veynes do run outward from the mammary veynes vnto the paps.

E, the gristles of the ribs which in women are somwhat bony because of the weight of the Dugs.

F, A part of the backe reflected or bent backward aboue the loines

GG, the compasse of the hanchbones running more outward, for the wombe to rest vpon, when a woman is with childe.

HH, the lower processes of the share-bones bearing outward that the cauity marked with K might be the larger.

I, the anterior commissure or coniunction of the share bones filled vp with a thicke gristle, that in the birth they might better yeelde somewhat for Natures necessity.

K, A great and large cauity circumscribed by the bones of the coxendix and the Holy-bone

L, the Rump or Coccyx curued backward to giue way in the time of the birth

M, the thigh bones by reason of the largenesse of the foresaid cauity haue a greater distance betwixt them aboue, whence a so it is that womens thighes are thicker then mens.

Table 5 sheweth the sceleton of a child new borne, wherein the bones are yet eyther gristly or membranous.

TABVLA V.

a, A thicke and for the most part square membrane betwixt the bones of the forehead & of the Sinciput which filleth vp the parts betwixt them.

c, The bone of the forehead diuided into two equall parts by the sagittall suture.

d, the separation of the lower Iaw into two bones.

e, the Scaly part of the Temple bones which in the middest indeede is bony, but in the circumference membranous.

f, the other part of the Temple bone which maketh a part of the stony bone, where the hole of hearing is gristly.

l, the sockets of the Iawes made to receiue the teeth.

mm, the body of the rack-bone distinct from his backpart.

nn, the backpart of the rackbones consisting of two broade and small bones, and of gristly processes.

o, the Holy-bone made of 5 racks with a gristle betwixt them.

p, The Rump gristle.

q the brest-bone, gristly in the circumference, but in the middest cõpounded of many bones.

rr, the large part of the Coxendix made of three bones, with a gristle betwixt them

ss, the second part of this bone making the parts of the Coxendix & the share-bones.

t, the third part behind making the same parts with the second.

uu, the whirle of the Knee which is gristly.

x, the wrest of the hand gristly.

y, the Arter-wrest of the foote gristly.

* Although all the appendances of the bones in infants are gristly, yet this * maketh the most notable as those of the arme, the blade, the Cubit, the haunch-bone, the thigh and the legge.

TABVLA. VI.

Table 6. sheweth the bones and gristles of an Embryo or vntimely Birth.

The first figure sheweth the Embryo at 42. daies old, already formed and proportioned, when all the bones are like to curdled Cheese or to Butter.

Figure 2. sheweth the tender bones of an Abortiue fruite about 3. months old, which are more gristly then they are in a child borne in due time.

FIG. II

FIG. I

a a 1. Betwixt these letters is that space which on the toppe of the Scull is soft and membranous, the Arabians call it *Zeudech*, and commonly it is called *Fontanella*.

a 2, A thick membrane which goeth between the forehead bone and the bones of the *Synciput*.

b b 1, the ends of the arme gristly.

b 2, membranes betwixt the diuision of the bones of the head where afterward the sutures are.

cc 1, The soft appendices of the Ell and the Wand almost separated from their bones.

dd 1, the appendices of the thigh and the Leg.

ee 1, the bones of the after-wrest of the foote, altogether gristly.

z z, the nayles of the fingers which are conspicuous euen in an abortiue Infant.

CHAP. IIII. *A briefe diuision and Ennumeration of all the Bones in the body.*

THE whole Set or Pack of Bones called *Sceletos* we deuide into three parts; the *Head*, the *Trunke*, and the *Ioyntes*. The Scull which is called *Cranium* or *Calua* consisteth of eight bones, sixe proper and two common. The proper bones are the Fore-head bone, the Nowle bone, the two bones of the *Synciput*, and the two Temple bones, wherein are contained the three small bones of the Eare, the Mallet or Hammer, the Stithy or Anuell, and the Stirrup. The two common bones are the Wedge bone and the Spongy or Syue bone. The diuision of the *Sceletos*. The scull 8. 3. of hearing

The Face contaynes both the Iawes, both the vpper and the lower. The vpper Iaw consisteth of eleauen bones. The lower Iaw of two onely, vnto both these are 16. Teeth articulated by way of mortize or by *Gomphosis*, of which foure are called *Incisores* the Sherers, two are called *Canini* the Dog-teeth, and ten *Molares* or the Grinders. The Iawes 13 Teeth 32.

The Trunke is deuided into the Spine, the Ribs and the Bone without a name. The Spine hath foure parts: the Necke, the Backe, the Loynes and the Holy-bone. The Neck hath seauen rackebones which are called *vertebræ*. The Backe twelue, the Loynes fiue, and the Holy bone 4. or 6, whose extremitie is called *Coccyx* or the Rumpe. The ribs are twelue on either side, seauen true Ribs and fiue bastard Ribs, to which are articulated on the foreside the Breast-bone, aboue the Coller bones and on the backesides the shoulder blades. The bone without a name (and I thinke it better so to leaue it then to giue it an vnfit name) hath three parts; the Hip, the Hanches and the Sharebones. The spine 28. The rumpe. Ribs 24. Breast bone 3 Coller bone 2 Shoulder-blades.

The third part of the *Sceleton* is called the Ioyntes, and there are two of them, the Hand and the Foote. The Hand is deuided into the Arme, the Cubite and the Hand properly so called. The Arme hath one bone the Cubit 2, called the Ell and the Wand. The Hand properly so called is deuided into the VVrest, the Afterwrest and the Fingers. The VVrest hath eight bones, the Afterwrest foure, the fingers fifteen, to which you may adde the Seede bones called *Sesamoidea*. Arme 1. Cubit 2. The hands 54 The seed bones.

The Foote is deuided into the Thigh, the Leg and the Foote properly so called. The Thigh hath one bone: the Legge two, one retayneth the name of the whole and is called the Leg-bone, the other we call the Brace-bone, in Latin *Fibula*. The Foote properly so called hath three parts as had the Hand, the VVrest, the Afterwrest and the Toes. The VVrest which is called *Pedium* hath seuen bones: the Afterwrest *Metapedium* fiue bones: The thigh 1. Leg 2. Feete 52.

The Toes foureteene. To all theſe wee may adde the bone of the Tongue called *Hyoes* which hath no articulation with any other bone; and this is the briefe ſumme of all the bones in the body. Now we proceed vnto their particular Hiſtory.

CHAP. V. *Of the Sutures or Seames of the Scull, and of the ſubſtance thereof.*

COncerning the Figures or formes of the Head, we haue ſpoken before ſufficiently in the fourth Chapter of the ſeauenth Booke, and therefore here wee will not ſtand either to repeate or enlarge this argument, but come directly to the bones of the Scull.

The Scull

The Scull therefore is called in Greeke κράνιον, in Latine *Caluaria*, and is that bone which compaſſeth the whole brayne, being put vpon it as a Head-peece or Murrion, for more ſecurity and ſtronger defence, becauſe vnderneath it, are contayned ſo noble and neceſſary parts.

Not of one bone.

The Scull alſo for further ſecurity was made round and large, becauſe it was to contayne a great quantity of Brayne and After-brayne. It was not made of one bone for feare leaſt by one wound it might haue beene throughout fractured, but of many ioyned together by ſutures or ſeames, as well for ſecurity as alſo to make the Head leſſe ſubiect to offence: for were it not for theſe ſeames, in vehement motions the bones muſt needes ſtart aſunder.

The ſeames.

The faſhion of theſe Seames is of two ſorts: the one playne and linear like two bords glewed, or ſtones cæmented together: the other indented like the teeth of two Sawes ioyned together, or like a looſe ſeame of a garment when it is ſlackly ſowed. It is very rare to finde the head without ſeames, although *Ariſtotle* report ſuch a thing, as alſo *Pollux* in his ſecond booke, *Herodotus* in his ninth, and *Columbus* vpon his owne experience. Sometimes we finde the *Coronall* ſuture to bee obliterated, ſometimes one of the other, ſometimes in old bodies through length of time and drith all the ſeames do grow together by coalition, as doe the Appendances of bones, and their ſutures are ſo aboliſhed that ſcarce any footſteps of them doe remayne, which in yonger bodies are moſt conſpicuous.

Of all the Sutures ſayth *Falopius* thoſe of the Temples doe continue the longeſt. *Hippocrates de vulneribus capitis*, and *Galen* out of him do ſay, that the ſutures do change their poſition and number according to the different figures of the head, ſo that in thoſe heads wherein the *anterior* prominence is wanting therein alſo is the *Coronall* ſuture abſent, where there is no prominence in the Nowle there is no *Lambdall* ſuture: yet alwayes the *Sagittall* ſuture remayneth, and then the figure of the remayning ſutures is like T. But where both prominences are wanting, there are 2. lines interſecting themſelues through the Scull like X. *Columbus* for this reprehendeth *Galen*, and ſayeth hee hath handled ſixe hundred thouſand Sculs (he meanes a great many in ſome Church yard or Cloyſter) yet neuer found any whoſe figure was not naturall, or which wanted either the *Coronall* or *Lambdall* ſutures. *Falopius* alſo in this is againſt *Galen*, and ſo is *Euſtachius*. *Bauhine* cannot approue it, for ſayth he we often find heads which want either the *interior* or *poſterior* prominence and yet haue all the ſutures. Againe, ſome wee finde without the *Coronal* ſutures, when notwithſtanding the fore head beareth out; ſome without the *Lambdal* ſuture though the Nowle be būching: ſome without the *ſagittal*; ſoe are foūd without any ſuture at al, though no prominence be wanting: not that theſe ſutures are deficient from their originall or from the birth, but they are therefore aboliſhed becauſe they oftentimes grow together whether the head be well formed or no. For if the prominences were the cauſe of the ſutures, then where there are no prominences there ſhould bee no ſutures, but in the ſide of the head at the Eares where the Scull is depreſſed there are ſutures without prominence.

Their differences.

The Sutures are called ῥαφαί, and they are of two ſorts; ſome are proper to the Scull it ſelfe, ſome are common to it with the vpper iaw. The proper ſutures are againe double, True or Falſe: the True are three, the Falſe ſixe. The common ſutures are fiue. The true ſeames are two tranſuerſe, and one lengthwiſe, ſo that together they make ſuch a figure as this. Υ

The Coronall ſuture.

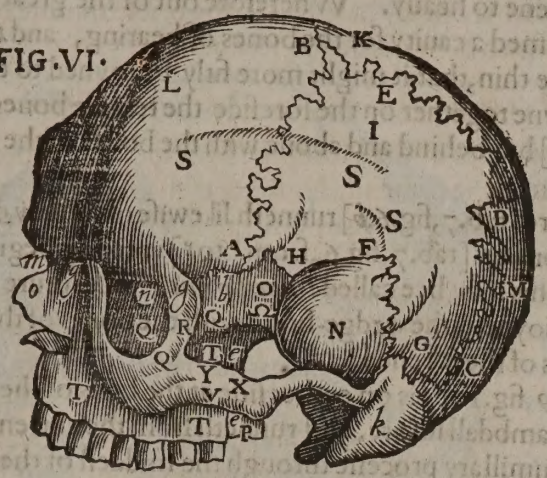
The firſt or the *anterior* or the tranſuerſe [table 7.[AB] tab. 9. fig. 11.[nn]] is called στεφανιαία, *Coronalis* the Crowny ſuture, becauſe the auncients were wont to weare their Crownes or Garlands in that place; not ſuch Crownes as Kings weare, and

at

TABVLA VII.

Table 7 sheweth some bones and sutures of the head. Fig.6 sheweth the left side. Fig.7 sheweth the right side, the yoke bone beeing removed. See the description in Lib.7, folio 438.

FIG. VI.



VII.

at this day amongst vs, Gentlewomen doe in that place where there Wyers or Tyers of haire, and oftentimes lay some peece of Scarlet or such like vnderneath to defend the mould of the head, (for so wee commonly call it) from the ayer. This suture resembleth a transuerse circle, for it runneth ouerthwart aboue the forehead as farre as to the scaly agglutinations, and it separateth the forehead bone [ta.7, L from I to K] from the bones of the *Synciput*, or it ioyneth them together.

The second or posterior suture [Tab.7, c D. tab.9, PP] is in the backpart of the head, and ascending obliquely from the basis of the nowle to the rootes of the mamillary processes, at each eare determineth at the middest of the sagittall suture. This suture because it is like the letter Λ is called *Lambdoides*. It separateth the nowle bone from the bones of the *Synciput* [ta.7, M from I K] and the temple bones. [tab.7, N] But in those men whose Sculs are large behind this suture is altered into others of diuers formes; sometimes the bone is diuided by a transuerse suture; somtimes it is circumscribed with a double suture as if a greater Triangle should comprehend a lesser; somtimes with a treble, as if a greater Triangle should comprehend two lesser; and these bones so circumscribed are by some called *Triangularia*, and are commended as of much auaile in the *Epilepsie* or falling sicknes. The 3 suture is in the midst betwixt the former two, [Ta.7, fi.1, E] and commonly (as you may see in grown bodies) it rūneth from the middle of the Lambdal throgh the middest of the length of the head to the midst of the crowny suture; somtimes it breaketh through it and diuideth the forehead bone iust in the midst vnto the top of the Nose, which is alwayes to be seene in Infants, in some children till they be 7 yeares old, in women but rarely, in men more rarely, and especially in those that haue flat faces. It is called *Sagittalis* because it is straight like an arrow. It diuideth the two bones of the *Synciput*; somtimes also as we haue saide, the forehead bone, and somtimes it cutteth also a part of the Nowle-bone: And thus much of the true sutures.

The Lambdal.

Sagittalis.

The Bastard sutures are so called because they be not so euident and conspicuous as the former, or rather because they belong to the second kinde of seame which is plaine, lying as the scales of a fish one aboue another. Some reckon foure, others fiue, we with *Bauhine* will account six. The first is at the sides of the cauities of the Temples on each side one. [tab.7, F, G, H] It runneth with a circular passage vpward from the roote of the mammillary processe and passeth downeward vnto the basis. [Tab.7, fig.6, from F, G, H, to Ω These sutures are not made by coniunction but rather by superapposition, so that the bone of the *Synciput* is by little and little attenuated like the plate of a Iacke or scale of a fish, and lieth ouer the temple bone. And therefore they are not simply called sutures but *Squamosæ adglutinationes* and *Squamiformes suturæ*.

The bastard sutures.

The first.

Now the reason why Nature ioyned the bones of the *sinciput* and the temples together like scales was, because she determined to place in the latterall parts of the temple-bones the smal bones of hearing, for which end she stood in need to make the bones of the

hollow, whereas if both bones had beene thicke there had beene no roome for the cauity, and beside the head would haue beene to heauy. Wherefore out of the great bone of the temples being attenuated, is formed a cauity for the bones of hearing, and the other bone of the *Synciput* was also made thin, that it might more fitly be ioyned to the tẽple bones. These two sutures do ioyne together on the foreside the temple bones with the wedge-bone; [tab.7,fig.6,ᴺ with ᴺ] but behind and aboue with the bones of the *Synciput*.

The fist. The fist, or the second bastard suture [tab.7,fig.6,*b*] runneth likewise obliquely downward at the sides from the top of the former [tab.7,fig.6, from ᴿ to ᴿ] vnto the beginning of the first common suture; [at ᴿ] and this may bee called *Cuneiformis*, the suture of the wedge-bone; for on the vpper part it ioyneth the wedge-bone with the bones of the *Synciput*, on the lower part with the bones of the forehead.

The sixt. The sixt suture [Tab. 8,fig.9,ᴹᴹ tab.9, fig.10,ᶠ] is on eyther side at the basis of the head; oblique also and continuall with the Lambdall suture, and runneth from the extremity of the same close by the roote of the mammillary processe through the middest of the stony bone obliquely inward to the basis of the head, where it is ioyned to the first rackbone as farre as to the transuerse line; but because it doth not so exactly expresse the forme of a suture, but seemeth rather a simple line, therefore some haue called it *Lambdoides Harmonialis*, others *Lambdoides inferior* and *Galen* an additament of the Lambdall suture; & this suture or line is common to the Additament of the nowle with the lower part of the temple bone and the Organ of hearing. In children it is very manifest but in growne bodies by degrees it vanisheth away so that in old men there is no remainder or shew of it.

The seuenth. The seauenth suture [tab.8,fig.9,ⁿⁿ tab.9,fig.10,ᵗ] is a line in the middle of the basis of the head which runneth on eyther side ouerthwart with a short course till it end into the chinke or rift which is common to the wedge-bone with the temple bone. This is common to the Additament of the nowle with the wedge-bone, and ioyneth together the end of the Lambdall suture.

The eight. The eight [tab.9,fig.10,ᵘᵘ] is most conspicuous on the inside of the Scull. It runneth ouerthwart on both sides in the forepart thereof, and reacheth to the lower angles or corners of the spongy bone and the cauities of the Nosthrils. It is common to the forehead with the fore-part of the wedge-bone. Moreouer it separateth the spongy bone on euery side from the fore-head bone, which seeme rather to be ioyned by *Lineall harmony* or *Cæmentation* then by suture.

The ninth. The ninth [Tab.9,fig.10, from ᵘ by K I vnto ˣ on the left side] on the outside almost in the middest vnder the spongy bones of the Nosthrils appeareth foure square, and runneth obliquely according to the forme of the wedge-bone, so that it is common to the spongy bone as it is referred to the Scull: on the backpart with the wedge-bone, on the forepart and in the sides with the forehead bone: and these are the sixe bastard sutures which with the three true sutures make nine proper sutures of the Scull.

The common sutures of the Scull. The Sutures which are common to the Scull with the bones of the vpper Iaw wherby the processes of the bones of the Scull are fastened on the outside are accounted fiue.

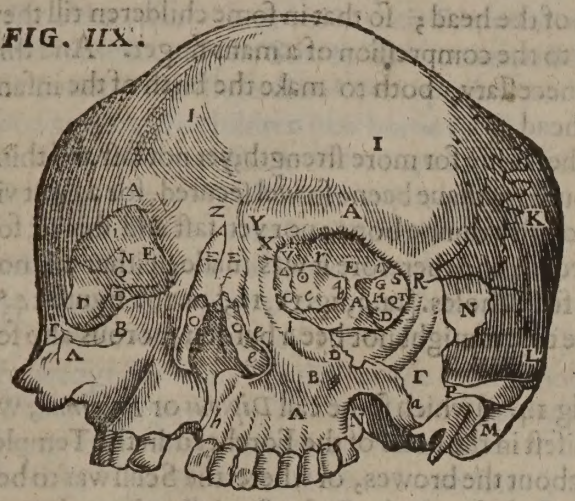
The first. The first is in the outside of the eye-brow, [tab.7,fig.6,7,ᵍᵍ Tab.8,fig.8,ᴿ fig.9,*g*] and runneth outward from the end of the fist suture and the second common suture, and expresseth the right forme of a suture indeed, and it is common to the bones of the forehead and the first bone of the vpper Iaw.

The second. The second which *Archangelus* maketh a proper suture of the Scull and *Columbus* accounteth for the sixt, appeareth in the vtter and laterall part of the orbe of the eye, and as if it were double is distinguished with a long common perforation; aboue it runneth downeward [Tab.8,fig.8, from ˢ to ᵠ and fig.9, to ᵈ tab.7,fig.7, to ᵈ] from the outside of the orbe of the eye and the cauities of the temple bones vnto the foresaide perforation & becommeth common to the wedge-bone with the first bone of the vpper iaw, which maketh the outward angle; below it runneth directly downeward at the sides of the Pallate and the cauity of the Nosthrils from the foresaide perforation euen vnto the roots of the teeth, [tab.8,fig.9, from *d* to *e*] and is common to the wedge-bone with the fourth & sixt bones of the vpper iaw.

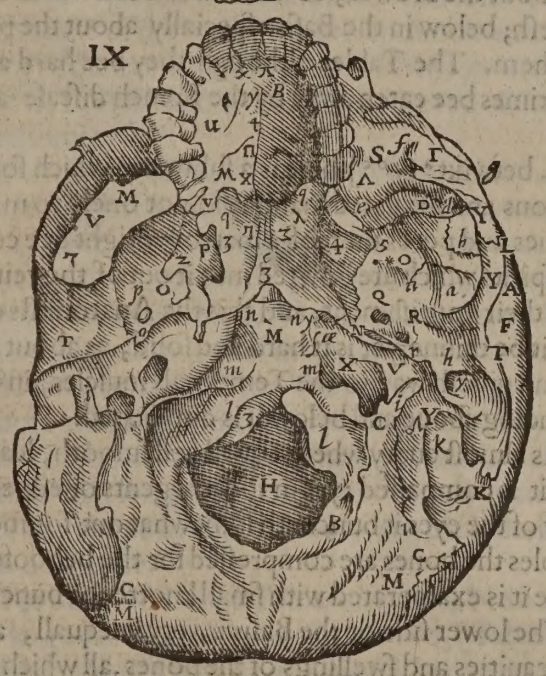
The third. The third, which *Columbus* accounteth for the eight, is seated in the inside of the orbe of the eye and the cauity of the Nosthrils, and runneth obliquely outward from the roote of the eye to the top of the Nose, [Tab 8,fig,8,ᴿˢᵀᵛˣʸᶻ] and is common below, by a short

TABVLA VIII.

FIG. IIX.



IX



See this description lib.7. cap.4. fol.439.

short cutte to the protuberation of the wedge-bone with the third bone of the vpper iawe; the rest of his passage ioyneth the outward table of the forehead bone, with the second, third, fourth and fift bones of the vpper iaw.

The fourth. The fourth belongeth to the yoake-bone and runneth obliquely thorough the middest thereof, [ta.7.fig.6.[x] tab.8. fig.9. [x] fig.8.[r]] and ioyneth the processe of the temporall bone with the proces of the first bone of the vpper iaw.

The fift. The fift is belowe in the cauity of the Nostrilles, and runneth [ta.8.fig.9, vnder z] from behind forward betwixt the processes called the *Bats-wings*, and is common to the wedge bone with the partition of the nosethrils. It is also to bee obserued that all the coniunctions of the bones of the head which outwardly are sutures, on the inside doe rather seeme to be ioyned by *Harmony* or *Cæmentation* then by suture: on the contrary sayeth *Eustachius*, in the Scull of an Ape, they are each where so obscure, that for the most part they doe not deserue the names of sutures. In some men also they are greater and more loose, in others smaller and more compacted.

The first sort are lesse troubled with paynes in the head from internall causes, albeit *Celsus* in the first Chapter of his 8. book is of another minde; neither ought any man to wonder much thereat, because Anatomy in his dayes was but in the Infancy, and beside that kind of learning among the Romans was but geazon: the other whose sutures are more compacted, are obnoxious or subiect to continuall and great paynes of the head, because the sooty excrements are retayned, which with their acrimony or sharpnesse doe goade the membranes, and with their aboundance distend them.

The vses of the sutures. The vses of these sutures are; first to be vents of the brayne, that the thicker and sooty excrements might exhale. But this was not the only vse; for then the Scull might haue beene bored through with small perforations to haue serued that turne; but it was necessary that the *Dura meninx* should issue forth and be suspended to the Scull, least the hardnesse thereof should presse the brayne or the ventricles therein: beside the Filaments or strings do make the *Pericranium* and the *Periostium*. Furthermore, the sutures were made for the ingresse and egresse of vessels for the nourishment and life of those parts.

Fourthly, that if at any time the head should happen to be broken, the fracture might not run through the whole skull but stay at the end of the fractured bone. Otherwise if a fracture were made in the forepart, the fissure or cleft would passe in the continuation of the bone vnto the hinder part, as it will doe in an earthen pot. Finally, Nature found it needfull that some parts of the scull should be thicker, others thinner, some of one forme some of another; and therefore she thought it fit rather to make it of many bones and to ioyne them together by sutures, then to make it of one onely bone, which must haue had so great variety of parts. We may also adde with *Galen* in the 22. chapter of the 13. book of his Method, and *Ealopius* maketh it the 7. vse; that medicines which are to bee applyed outwardly might better enter into the braine and affect it. And thus much of the sutures.

The substãce of the scull.

The substance of the Scull varieth according to the age of the partie. For in children newe borne it is very soft, afterward it is gristly and membranous, especially about the commissures or seames [ta.3.ta.4:figure 1.betwixt [a] and [b], especially ta.4.fig.2, betwixt [a] and [a]] and in the vpper and middle part of the head; so that in some childeren till they haue passed ouer some yeares it wil yeild to the compression of a mans finger. And this tenerity or softnes of the Scull was very necessary, both to make the birth of the infant more easie, as also for the growth of his head.

But in growne bodies it is altogether bony for more strength; yet not fast and thin, for then the parts contayned vnder it would not haue beene so wel secured, for a light violence would easily haue penetrated through a thinne bone: nor yet fast and thicke, for then it would haue beene too great a burden; and therefore it was made neither fast nor thinne; but thicke, rare and cauernous or full of holes. [ta.9, fig.11, 12, [b] ta.10. figure 14.[c]] Thicke for security and strength, and rare that it might not bee a burden, porous also for Transpiration.

The double table.

It is made of a double scale [ta.10.fig 14.[a°]] which some call *Diploas* or *Laminas*, we will cal thẽ Tables, which are most manifest in the bone of the Forehead, in the Temple-bones, in the Wedge bones especially about the browes, or where the Scull was to bee made thick, as aboue where there is no flesh; below in the Basis especially about the perforations and the cauities to strengthen them. The Tables although they bee hard and somewhat thicke, yet the vtter may sometimes bee eaten away by the French disease and the Patient recouer notwithstanding.

Betwixt these Tables [ta.10.fig.14. betwixt [a] &[c°]] there is a substance which some haue compared to a Pumie stone, fungous and fistulated manifould, not onely to make the Scull the lighter, but that in the cauities and pores thereof a marrow might bee contayned, in which marrow the bloud and spirits which are powred into it out of the veines and arteries thither ariuing, is boyled for their nourishment, and this the Anatomists call *Meditullium*. In other parts although it be thinne, yet is it hard and solid, as about the Temples where it is very thinne indeed and giueth way to the Temporall muscles, in the cauity also of the eye where notwithstanding aboue and below it is duplicated.

The surface

The outward surface of the Scull is almost euery where equall and smooth, least it should hurt the *Periostium* wherewith it is compassed: yet in the margents or edges of the forehead bone, and aboue the cauity of the eyes it buncheth somewhat out for more strength: againe, at the sides of the Temples the bones are compressed for the behoofe of the Temporall muscles, and in the Nowle it is exasperated with small knottes or bunches made for the insertions of the muscles. The lower side or the Basis is very vnequall, and rough by reason of the many processes, cauities and swellings of the bones, all which we shall make mention of in their particular History.

The inner cauity.

The *Internall* cauity is also for the most part smooth, that the *Dura meninx* whereby it is compassed might not be offended. In the top as it were of the Helmet it hath shallow cauities, in the forehead bone and the bones of the *Sinciput*, whereto the *Dura Meninx* doth grow, & inscriptions also or lines for the courses of the veines: but below there are diuers productions, extuberations, & small bosomes made to receiue the different figures of the parts of the Brayne, the After-brayne and the instruments of the Senses.

Perforations.

Both Tables are perforated with many small holes, thrilled not in order but wildly and as it were at aduenture, and those transuerse or oblique, through which small veines and arteries do passe into the cauity of the inner bones and the *sinus* of the *Dura meninx* or hard membrane.

Moreouer the small cauities or dens that are in either Table doe make way for the Transpiration of subtile and thinne vapours, which if they be retayned doe breede giddines and other diseases. For the head is set aboue the rest of the parts as a roofe vppon a house that is kept hot but without a chimney: whose rafters, because the smoake hath no vent, wil become black and sooty. Beside these, most bones of the head haue their proper perforations, cauities, *Sinus* or bosomes and processes, of which we shall speak in the particular History of each bone.

CHAP. VI. *Of the proper Bones of the Scull.*

THE Bones of the Scull are of two sortes: some belong to the Scull it selfe, some to the Iaw, which is double, the vpper and the lower. The bones of the Scull in grown bodies are commonly 14. whereof some are proper others are common. The pro-

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per bones are in like manner double, ſome make the circumference of the ſcul, and theſe are commonly accounted ſixe. The fore-head bone, the two Bones of the *ſynciput*, the Nowle-bone and the two Temple-bones. The other ſerue onely for the ſenſe of hearing which likewiſe are ſix, three in each Temple-bone called the Hammer or Mallet, the *Stithy* or Anuile, and the Stirrop. The common Bones of the ſcul are ſo called, becauſe they are common to the ſcull and the vpper iaw, and theſe are two, the wedge-bone and the ſpongy bone. In children new borne the Bones of the ſcull are 22. two of the fore-head, two of the *ſynciput*, foure of the Nowle, two of the Temples, two Labyrinths, ſixe of the Hearing, one wedge-bone, one ſpongy bone, and two without names.

The diuiſion of the bones of the Scull.

The firſt is the fore-head bone [Tab.7.fig.6,7 [L].Tab.8.fig.8.I I] ſeated before, for it maketh the forepart of the ſcull both aboue and below, and the whole forehead, and the vpper part of the orbe of the eyes. It is tyed aboue to the bones of the *ſynciput* [T.7.fig.6 [I K]] by the *Coronall* ſuture; [Tab.7.fig.6[c] fig.7 [A B]] belowe, partly to the bones of the ſcull as the wedge-bone, and on the outſide to the bones of the Temples by the *ſcale-like* ſuture; [Tab.7.fig.6 and 7 [A B]] on the inſide by the eight ſuture, [Tab.9.fig.10.[T U]] as alſo to the ſpongy bone which it doth as it were encompaſſe by the ninth ſuture: [Tab.9.fig.10 from [U] toward [K I]] partly it is committed vnto ſome bones of the vpper iawe, to the firſt in the vtter angle of the eye by the firſt common ſuture [Tab.8.fig.8.[R] Table.7.fig.6 and 7[R]] againe in the cauity of the orbe of the eye, to the ſecond, third, and fourth bones; [Tab.8. fig.8 S,T,V,X] and to the fifte in the top of the noſe [Tab.8.fig.8[Y Z]] by the third common ſuture.

The forehead bone.

This forehead bone in growne bodies is but one, very rarely two [Tab.3[c] Tab.6. fig. 2 *aa*] though it be alwayes ſo found in new borne infants, diſtinguiſhed by the *ſagittal* ſuture; ſometimes it continueth ſo to the ſeuenth yeare, but is afterward obliterated, the bones growing together. The figure of it is after a ſort circular. The ſubſtance in a mean betwixt the bones of the *ſynciput* and the nowl-bone: in infants that part where it is commixted with the bones of the *ſynciput* and meeteth with the *ſagittal* ſuture; is very thin, and in new borne infants [Tab.9.fig.11[Y]] but onely membranous, in growne bodies it is more thin and infirme in the cauity of the eyes and where it is ioyned with the eight bone: in ſome places alſo it hath two tranſparant ſhels or ſcales. Toward the ſutures it is thicker, that it might faſten more ſtrongly with other bones, as alſo at the toppe of the noſe and aboue the eye-browes, where it is diuided as it were into two partes to make a *ſinus* or Denne.

The cauities thereof.

For betwixt the two Tables aboue the Noſe in the Region of the Eye-browes, there are large cauities for the moſt part two, [Tab.9.fig.10 & 11[Y]] one on the right hand, another on the left, which are diſtinguiſhed with bonie Fibres and ſmal ſcales. Sometimes alſo, they are ſeparated and encompaſſed with a greene Membrane, which contayneth a ſoft medullous and as it were an oyly bodye. In theſe boſomes there are perforations which determine partly into the cauity of the noſethrils, and one [Tab.9.figu.10. aboue x] which endeth into the ſcull preſently aboue the partition [tab.9.fig.10[x] T.10.fig.12[x]] of the ſpongy bone, whereby the organs of Smelling are diſtinguiſhed. But theſe boſomes are not found in thoſe that haue flat faces and ſaddle noſes, neither yet where the forehead is diuided. They were formed to make the voice more ſhril, and thence it is that ſuch as ſpeake in the noſe haue them not.

Their vſe.

Againe, they were made to conteine the aire which is drawne in by the noſtrils, that being altred it might firſt be conueyed to theſe boſomes, and from thence by degrees to the organs of ſmelling and ſo vnto the Braine to make alteration therein: they ſerue alſo when the Braine is affected to reduce it vnto his natural ſtate, as when for a moiſt Braine we appoint a Pomander wrought vp with Muske and Amber-greece; the Muske & Amber warmeth the aire that is drawne in by the Noſethrils and conueyed to theſe boſoms; and hence it is that oftentimes an odour that is drawne in by the Noſethrils remayning in theſe cauities, is felt a whole day together in the top of the Noſe. Some thinke, as *Archangelus* and *Piccolhominie*, that the matter conteyned in them is ſomewhat like vnto Oyle, paſſeth thorough the perforation that is in the greater angle of the eye, and moiſteneth the ſame, whereby it is made glib and his motion more quick and ſpeedy.

The Denne.

Beſide theſe, there is alſo a Den made of a double ſcale, the vtter ſcale maketh the vpper part of the Orbe of the eye [Tab.8.fig.8.aboue [R]] and is plaine; the inner maketh the cauity aboue the eyes on either ſide [Tab.9.fig.2 [Z]] and is not plain but hath inſcriptions

The perforations.

tions answerable to the winding convolutions of the Braine, whose protuberating portions it receiueth. A *Sinus* also runneth through the middest of this Bone, as farre as to the spongy-bone, which was made for the third *sinus* of the *dura Mater*, to giue way vnto it that it should not be pressed by the forehead bone.

Holes it hath in the place of the Eye-browes, sometimes two, sometimes three; & three beside peculiar vnto it, one on the inside in the coniunction of the spongye bone with the forehead bone where it passeth into the sinus, of which we haue spoken before. Beside two on the outside at the middle of the browes, on either side one [tab.8.fig.8 AA] which is sometimes orbicular, sometimes long, and endeth into the orbe of the eie; thorough which a branch of the Nerue of the third coniugation is transmitted out of the orb of the eye to the musculous skin of the forehead, haply also vnto the Muscles of the eyelidds, whence it is that oftentimes when a man rubbes his fore-head hee will sneeze vpon it.

His processes.

Finally, the forehead bone sendeth foorth two processes, one vnto the lesser, another to the greater angle of the eye which make the vpper brimmes of his orbe: and so much of the forehead bone.

The *Synciput*.

The Bones of the *Synciput* are so called, saith *Arch.* of *συν before*, and *Caput* the *Heade*, because they make the anterior or forward part of the head. In Greeke they are called ὀστᾶ βρέγματος, which word *Eustathius* vpon *Homer* acknowledgeth to bee giuen, because in Infants that part is not onely tender but very moist: or rather saith *Bauhine*, because therevnder lyeth the moist and soft Braine. They are called in Latine *Ossa verticis*, because they make the heighth or top of the head: [tab.7.fig.6.I K] also *Parietalia* the VVall-bones, & by *Volcher*, the *Bones of Reason* or *Discourse*.

They are two ioyned together in the midst of the length of the head by a suture common to them both, called *Sagittalis*; [Tab.7.fig. 6 A] and so ioyned make the vpper part of the scull, as also the sides for the most part as farre as to the eares. They are fastned also to the adiacent bones, on the foreside to the forehead bone by the coronal suture, [t. 7.fig.6 AB] behinde to the *Occiput* or Nowle by the *Lambdal* suture, [tab,7.fig.6 DC] on either side to the bones of the Temples by the scaly sutures, [tab.7.fig.6 G FM] and finally to the wedge-bone by a part of the fift suture. [tab.7.fig.6 & 7 H, A]

Their forme is almost foureſquare and almost equally thicke, sauing that they are attenuated where they are ioyned to the Temple-bones.

Forme and substance.

Their substance in growne bodies is hard and solid, yet in respect of other bones very rare and weake, and this haply is the reason why wounds in the *Synciput* are most-what mortall. In infants (I speake not now of Beastes but of men) the anteriour part of these Bones where the Sagittall suture is ioyned with the Coronall [tab.7.fig.6 BN] this part is Membranous and hardneth by degrees, and the two Bones do grow together and are indurated: last of all the Bones of the Head, and some haue thought as *Aristotle* and *Pliny*, that it is not possible children should speake, before the whole scull bee become Bonie.

The breach betwixt them

Because of this softnesse when the Bones are not yet so well growne that they can couer the whole Braine, you may obserue about the crowne of the head as it were a breach or Den, [Tab.9.fig.11 Y. tab.6.fig.11, *aa*] which the Arabians call *Zeudech*, the Barbarians because of the moysture and pulsation do call it *Fons pulsatilis*, the beating fountaine. Others call it the *Foutanel*, and indeede in that place at this day wee vse to apply Cauteries, and the Ancients vsed red-hot frying pans in fits of the Apoplexy, for so I may cal them with good warrant: if you wold know the very place of this coniunction in a liuing body, let him lay the roote of the palme of his hand betwixt his browes, and the middle finger will designe the iust place.

These Bones haue on the inside superficiall cauities or small Bosomes, to which the *dura Meninx* growes, as also inscriptions [tab.9.fig.10 and 11, SS] for the vessells which run from the internall iugulars through the thicke Membrane of the Braine. They haue also some smal perforations, especially outward at the sides of the Sagittall suture which perforate the Bone from one side to another, and transmit small veines for nutrition.

The Nowle-bone.

The Bone of the *Occiput* or the Nowle-bone [Tab.7.figure.6 & 7 M tab.8.figu.9 MM] is called *Occiput*, of *Oc* for *Ob* and *Caput*, because it is behinde the head. Some call it *Os basilare*, the Arabians *os Proræ*, and *os Memoriæ*, as if the memory were seated in it. The situation of it is behinde, and it maketh the backward and lower part of the Scul and the mid-

dle

dle part also of the Basis. *Platerus* sayth it is alwayes one; but sayth *Bauhine* I haue a Scull wherein it is made of three bones, and *Eustachius* maketh mention of the like.

In children till they come to the end of the first yeare it consisteth of foure bones; one aboue which maketh the greater part of the capacity, and in some bodies is diuided in the middest by the sagittall suture. Another below vnder the great perforation which they call his additament; at the sides of that perforation are the 2. other very thin bones and *gristle bound* or vnited by *Synchondrosis*, for they are deuided by lines filled with a gristly substance, which becomming in time harder is turned into a bone. It is fastned aboue to the bones of the *sinciput* [ta,7,fig,6,ik] by the *Lambdall* suture, [tab. 7, fig. 6, cn] at the sides of the Temple bones by the additaments of the same *Lambdall* suture, or by the sixt suture; [ta.8, fig.9, m c] and in the middest of the wedge bone [t.8, fig.9, OO] by a transuerse line or suture, or by the seauenth suture which is common to it with the wedgebone [ta.8, fig.9, fn.] His connexion.

The figure of it is almost rounde or rather *dianguliar*, consisting of two circular lines which end into sharpe determinations. Figure.

The substance is hard and fast aboue all the bones of the Scul, and thickest at the *basis* where it is without flesh, and where two *sinus* of the *Dura meninx* are ioyned, [ta.9, fig. 10, vnder fgh] for it behoued well that it should be stronger then the forehead bone, because it is behinde where it could not so well haue beene attended vnto. At the sides of the great perforation [ta.8, fig.9, m ta,9, fig,10.d] it is somewhat thin, (*Aristotle* sayeth the thinnest of all bones, but he mist his marke) and without any cauities or small dens therein, but in the middest to strengthen it the more because of his thinnesse, there riseth and runneth a long prominence [ta,9, figu,10, at h] throughout, to secure it if by chance a man should fall backward. Substance.

It hath nine *Sinus* or Bosomes, 7. on the inside; of which two are partly oblique & partly transuerse: on each side one which climeth obliquely vpward & backward through the temple-bones, [ta,9, fig.10, from b toward q] presently runneth ouerthwart [ta,9 figu, 10, and 11, about h] and so they meete in the middest of the Nowle. They are made to receiue two *sinus* of the *Dura meninx* that they should not be compressed by the bones of the Scull. *Sinus* nine.

The third *Sinus* is right, straight, and from the congresse of the former runneth directly vpward, and vnder the *sagittal* suture, and the middle of the foreheade bone attayneth vnto the spongy bone, [ta,9, figure 9, at h] and this *Sinus* was exsculped or grauen in the bone for the third *Sinus* of the *Dura meninx*.

There are two other bosomes seated aboue the transuerse, and distinguished by a right line. Their vse is the better to receiue the Brayne, which is double. There are yet two other large *Sinus* in the *Basis* below the transuerse, [ta,9, fig,10, g] which receiue the protuberations of the After-braine, and these are the seauen *Sinus* on the inside. Their vse.

On the outside there are two semicircular, made to receiue the two *anterior* processes, [ta,8, fig,9, ll.]

The perforations of the Nowle-bone are fiue: the first [ta.8, fig.,9, m ta.9, fig.10, d] is in the middest of the *Basis* of the Nowle. The largest of all the inward holes of the head; it is round but somewhat long, through which the marrow of the brayne falleth into the spine. It hath also two other perforations [ta.8, fig.9, r ta 9, fig.10, b] common to it with the temple bone, on either side one betwixt the head of the Nowle [ta.8, figu. 9, betwixt l and i] and the appendix *Styloides*. These are notable and long perforations, and seeme as it were double, for through it in the lower and vtter part doth passe the greater branch of the internall *Iugular* veine, and the lesser braunch of the sleepy artery: againe, through the vtter and inner part passeth the sixt coniugation of Nerues. The perforations.

Two other proper perforations it hath [ta.8, fig.9 ζ ta.9, fig.10, c] which are neare vnto the first, running obliquely inward and are orbicular: yet sometimes they are long for the transmission of the seauenth coniugation of sinewes which is presently ioyned to the sixt; sometime also it transmitteth a veine and an artery. Sometimes there is yet found another perforation on either side in the vtter part of the head of this bone [ta.8, fig.9, s] which is not very large because it runneth a long course before it gette within the Scull. Some thinke through it there passeth a veine and an artery which did climbe vp the transuerse processes of the Rackebones: but sayth *Bauhine* wee finde this perforation wanting oftentimes on one side, sometimes on both, and then these vessels passe through the two holes last before mentioned.

On

On the outside at the basis the nowle bone is rough and vnequall as well for the originall as for the insertion of the muscles and ligaments.

His processes or heads (for so we called them euen now and according to *Platerus*) are two, [Tab.8,fig.9,ll] broad before, and in infants they haue an Appendix couered also with a gristle, and protuberating more inward then outward, which processes are inserted into the Sinus of the first rack-bone to helpe the motion and articulation of the head. On the backside there ariseth a small processe which is receiued by the first rackbone.

Finally, in dogs from the nowle bone proceedeth another triangular bone situated which goeth betwixt the braine and the After-braine.

The temple-bones. The temple bones called ὦτα κροτάφων, are called by diuers names, *Ossa lapidosa*, *Saxea*, *Parietalia*, *Dura*, *Arcuali*, *a Squamiformea*, *Squamosa*, *Mendosa*, [tab.7,fig.6,and 7,ᴺ·ta.8,fig. 9,ᵀᵀ] their principall part is about the sides neare the eares, part of them also in the basis.

The conexiō. In growne bodies they are two, on each side one, but in children each bone by the interposition of a gristle is parted quite through the auditory passage. The footsteps of which diuision do yet remaine at the entrance of that passage. They are conioyned aboue with the bones of the *Synciput* by a proper Scully suture, [Tab.7.fig.6,and 7,G,E,F] somtimes also with the forehead bone below, and on the inside with the Additament of the nowle-bone by the sixt suture; [Tab.8,fig.9,ᵐ ⁿ] in like manner with the wedge-bone: before that is, at the sides, it is ioyned by that suture by which the stony-bone is annexed to the same wedge-bone, [Ta.7,fig.6,from Ω to H] but in the basis on the outside where the cleft is, they are parted asunder. [Tab, 8,fig.9,from ⁿ to °] Finally, they are ioyned with the first bone of the vpper iaw; [Tab.7,fig.6,ʳ] I meane their processe which is called *Iugalis* or the yoke (for that is a processe of the temple bone) by the fourth common suture.

Their figure and substance. Their figure is aboue ample, round and semicircular, but below it hath no shape but seemeth like a rude rugged and vnequall Rocke.

The substance is also full of variety, for at the basis they are thicke and rough like Rocks whence they are called λιθώδη *Petrosa*, *The rocky or stony bones.* Ascending they are by degrees attenuated, so that they were not so thicke at the basis, but they are as thinne at the top, yea transparent; especially where they giue way to the temporall muscle, and like scales are adioyned by the second kinde of suture to the bones of the *Synciput* which in their descent are attenuated to receiue them: and though the height of the temple bone be but thin in respect of his basis, yet it is harder and faster then the bone of the *Synciput* vnder it to which it is a kind of defence, and therefore cannot be broken without danger of death, although *Columbus* make mention ot two children cured of fractures in that place, the one at *Padua*, the other at *Rome*.

Parts. Moreouer if these bones had beene equally thicke throughout and not attenuated toward the top, their very waight, if nothing else, would haue beene burthensome. On the outside they are solid, smooth, and plaine; on the inside because of the conuolutions of the braine it hath many rising inscriptions. Againe in the basis of it wee shall finde one Appendix, three Processes, eight Perforations, and two Sinus or cauities of which we will speake in order.

Appendix. The Appendix is sharpe, long, and slender, and a little incurued like a Cocks spurre. [Tab.7,fig.6,and 7,ⁱ·tab.8,fig.9,ⁱⁱ] It is commonly called *Styloides*, sometimes *Belenoides*, *Graphoides* and *Plectrum*, that is, the *Bodkin*, the *Needle*, the *Pen*, and the *Cockspurre*. In children it is gristly, in growne bodies solid and hard, but because it sticketh farre out, a little thing will breake it off, which is the reason why wee finde it so seldome in Sculs gotten out of the ground, yea a little seething will make it fall away.

From this Appendix proceede the muscles which go vnto the bone *Hyois*, the tongue and the lower iaw to draw them downeward, yea the bone *Hyois* it selfe groweth thereto by the interposition of a ligament. So much of the Appendix.

The first processe is on the outside blunt and dull tending downward on each side one, which because they are like the nipple of a Cow are called *Mastoides mammillares*. [ta.7, fig.6,and 7,K.tab.10,fig.8,M,fig.9,K.] It is a thicke processe, spongy within and somewhat hollow, it may be for more lightnes, and it serueth for the insertion of the muscles which bend the head; wherefore it is rough and like a Rocke. The second processe runneth forward from the hole of the eare to the processe of the first bone of the vpper iaw to helpe to make the bone called *Iugale* or the yoke bone, for these twoe processes one of the Temple bone, the other of the first bone of the vpper iaw beeing ioyned with an oblique

oblique ſuture do make the faſhion as it were of a Bridge or of a yoke. [ta.7.f.6 & 7 V, X. ta.8.f.8 at r] The third proceſſe is on the inſide [ta.9.fig. 10 α α] and ſtony, ſwelling out in length; wherin there is a triple or threefold cauity. The firſt is called *Tympanum the drum*, the ſecond *Labyrinthus* the *Labyrinth*, the third *Cochlea* the *Snaileſhel*, where alſo there are 3 bones of hearing, all which becauſe they were made for that ſenſe wee haue handled particularly; the cauities of this ſtony bone in the 20. 21 and 22 chap. of the 8 Booke, as alſo the three bones of hearing in the 18 chapt. of the ſame Booke, where hee that liſteth may finde aboundant ſatisfaction, at leaſt ſo farre as we could ſerue his turne, for we haue handled them there very particularly. This third proceſſe in infants is called *the bone of the labyrinth*, becauſe it lieth vnder the ſcaly bones, & is ſo ſtraightly faſtned vnto them that at length they vnite; ſo it changeth his name and is called the interior proceſſe of the Stony bone. So much of the Proceſſes.

The bones of Hearing, and the cauities of the ſtony bone

The Perforations are of two ſorts, ſix externall and two internall, which doe let ſomething in or ſend ſomething forth, or both. The firſt externall perforation which *Platerus* calleth the third of the temples and the firſt of *Hearing*, [ta, 8.fig. 9 r] is verie large betwixt the Mammillary proceſſe and the Iugall or yoake-bone; becauſe it intromitteth or giueth way to the entrance of aire and ſounds. It is called by a proper name, *Meatus Auditorius the hole of Hearing*.

The perforations.

The ſecond perforation which *Platerus* accounteth for the firſt of the temples, is in the backſide, nere to but behinde the Mammillary proceſſe [ta. 6. fig. 9. x] and entreth into the cauity of the ſcull at the tranſuerſe and round ſide of the *Lambdal* ſuture.

This perforation is ſometimes wanting in one ſide ſometimes in both, but when it is there a branch of the externall Veine paſſeth through it.

The third perforation which *Platerus* accounteth for the ſecond of the Temples, is at the ſtony proceſſe [ta. 8. fig. 9 X] vnder the appendix called the *Bodkin* or *Styloides*. It is a great hole vnequall, and runneth oblique from behinde inward and forwarde, thorough which the greater branch of the Sleepy artery runneth obliquely vnto the fift hole of the wedge-bone, and from thence into the Ventricles of the Braine; by it alſo yſſueth a portion of the third Coniugation of ſinewes. It was bored aſlant or oblique that it might more ſafely paſſe without breaking from behinde forward. Some think the cauſe of the obliquity was, that the ſpirituous bloode might there make a certaine ſtay.

The fourth hole, which *Platerus* calleth the fourth of the Temples and the ſecond of *Hearing*, is likewiſe oblique, double and ſhort. [ta. 8 fig. 9 V] It intromitteth the Iugular veine, and ſometimes tranſmitteth a ſmall branch of the Auditory Nerue.

The fift, according to *Platerus* the fift of the temples and the thirde of Hearing, is betwixt the Mammillary proceſſe and the Appendix *Styloides*, a round perforation and determineth into the long Canale. It intromitteth the Sleepy Artery and giueth way vnto the egreſſe of a Nerue.

The ſixt, according to *Columbus* the fift, is betwixt the Nowle and the temple-bone great and vnequal, and bored for the egreſſe of the ſixt coniugation of ſinewes, and the ingreſſe of the internall iugular veine vnto the Braine.

The ſeauenth, the ſixt according to *Platerus* of the Temples and the fourth of Hearing, is bored in the backſide of the proces, [Ta. 9. fig. 10 a] it is long and as it were oual, dilated by degrees and runneth with a blinde paſſage (from whence it is called *Foramen cæcum*, the blinde hole) into the labyrinth: into this hole the Auditory nerue of the fifte paire doth paſſe.

The eight, according to *Platerus* the ſeuenth of the Temples and the eight of Hearing, is in the foreſide of the proceſſe; [tab. 9. fig. 10 againſt a] a narrow perforation and rugged like a rift, and it tranſmitteth from the organ of Hearing a ſmall Artery into the capacity of the ſcull. And thus much of the perforations.

The *ſinus* or cauities of the Temple-bones are two. One outward [Ta. 8. fig. 9 h] betwixt the hole of Hearing and the proceſſe of the yoake-bone: it is a long cauity, tranſuerſe and cruſted ouer with a Griſtle, and into it the longer proceſſe or the head of the lower iaw is inſerted and articulated, and this *ſinus* ſaith *Columbus*, *Galen* in his Booke *De Oſſibus* hath not rightly deſcribed. The other boſome or cauity is inward, at the backeſide of the proceſſe, long and oblique and common to the Temple-bone with the nowl-bone. [Tab. 9. fig. 10 from b toward i] And thus much of the proper Bones of the Scull.

The Sinus.

CHAP

CHAP. VII. *Of the Bones that are common to the Head and the vpper Iaw, that is to say, of the Wedge and Spongy bones.*

The Wedge-bone.

THE first Bone that is common to the Head and to the Iaw, is called *Sphænoides*, either becauſe it is like a Wedge, ſharpe aboue and thicke below; or rather for that like a VVedge it ſticketh betwixt the Bones before named and thoſe of the vpper Iaw. The Interpreters of the Arabians call it by diuers names, *os Paxillare*, *Celatorij*, *Baſilare* and *Canilla*. It is ſeated in the middle of the baſis of the Heade, yet ſo as that it toucheth almoſt all the bones of the head and the vpper iawe. It is ioyned before, to the fore-head bone by the eight tranſuerſe ſuture, [ta.9.figu. 10. from [t] to [u]] to the ſpongy-bone on the inſide by a portion of the ninth ſuture; [ta.9.fig.10 at the middle [u]] On the outſide at the cauity of the noſtrils, to the partition by the fift common ſuture; [ta.8.fig.9 nere [z]] behind, to the additament of the Nowle-bone by the ſeuenth ſuture; [ta.8.fig.9 [nn]] at the ſides to the temple bones by the ſcaly ſuture; [tab.7.fig 7 [a]] to the angle of the Bone of the *Synciput* by the fift Suture, [ta.7.fig.6 and 7 from [x] to [A]] and to the forehead bone by the ſame ſuture. [from [A] to [s]] It is alſo ioyned by his eminences or proceſſes to the Bones of the vpper Iaw, as on the inſide; with the orbe of the eye, with the third Bone of the Iaw by the third common ſuture. In the outſide with the firſt, fourth and ſixt Bones of the vpper iawe by the ſecond common ſuture. [ta.8.fig.8 from S to [c]. and fig.9 from [d] to [e]]

Connexion.

His parts.

In growne bodies it is but one bone, yet at firſt it is compounded of foure Bones with a Griſtle betwixt them, which ſaith *Falopius* in his Obſeruations do not appeare diſtinguiſhed after the ſeuenth month but are vnited. The firſt of theſe foure is the baſis, in middle almoſt of the head ſeparated by a tranſuerſe line from the ende of the additament of the Nowl-bone, and it containeth the Pituitary or Phlegmaticke Glandule, and becauſe it is like a ſaddle, is called the ſaddle of the Wedge-bone. [ta.9.fig.10, [E]]

The ſecond part of the wedge-bone hath no name, and is deſtined to beare vp the vnition of the Optick nerues, [ta.9.fig.10 [D]] and is coupled to the firſt with a plentiful griſtly ſubſtance, toward the palat there is in it a bony naile, whereto is faſtned a long & broad bone which is griſtly in the originall, and is like to the Cowlter that runneth before the Plowſhare. The third and fourth parts of this bone are two proceſſes, on either ſide one like to wings. [tab.8.fig.9.char.1,2,3,4] VVherefore becauſe this bone is made vnequal, with many proceſſes both within and without, it was called by the Auncients πολύμορφον, *Seare-ſhapt*.

His ſubſtance

The ſubſtance thereof is in the baſis denſe and faſt, partly becauſe the head lyeth vpon a baſis, and therefore the Barbarians call it *os baſilare*, partly that it ſhould not be hurt by the excrements that fall downe. In young bodies it is ſolid, but in growne hollowe in the midſt, for the hollowneſſe is made of the ſolid matter diſtended; for as hee that out of a little quantity of glaſſe bloweth a great Viol, ſo Nature according to the vſe ſhee had of this bone, firſt made it denſe and ſolid in children, and then dilated that denſity into a hollowneſſe, which is large and couered with a hard and faſt ſcale or ſhell not at all perforated; as for the inner part, there the ſubſtance is not ſo ſolid but ſomewhat ſpongy.

His proceſſes

It hath many proceſſes, ſome externall, ſome internall; within two on either ſide, which they call κλινοειδεῖς, becauſe they expreſſe or reſemble the lower part of a bed or a Table. [tab.9 fig.10, [aa]] The two forward of theſe are the larger and thicker, and from a broad baſis do end in a ſharpe Cone. The two Poſterior in ſome bodies doe not bunch out at all, but are euen like a Wall, and therefore ſome haue taken it for one Proceſſe.

Their vſe is, that the *Dura Meninx* might be more ſtrongly faſtened vnto the Scull. The outward proceſſes are double: before, one on either ſide neere the partition of the Bones of the Noſethrils and the Palat, in that place where it is ioyned with the vpper Iaw. And theſe proceſſes are likened by Anatomiſts to Bats wings, and therfore called πτερυγοειδεῖς, for they are thicke and yet end into a notable thinneſſe, almoſt as ſharpe as the edge of a Knife. [tab.8.fig.9.char.1,2,3,4. tab.10.fig.12 HH] They ſerue for a ſeate and a couering to the muſcles that lurke within the mouth: wherefore in the middeſt of them there is a deepe and long cauity from which the muſcle taketh his originall; and whereby it is defended. On the backſide, the bone hath two ſmall points bearing out toward the *Styloides*. The anterior of theſe is blunt, and from it the firſt muſcle of the Chops doth ariſe; the poſterior

ſterior is rough and ſharp from whence iſſueth the 5 paire of muſcles of the lower iaw or very neare vnto it. Finally, there iſſueth another proceſſe from the middle edge thereof which deuideth the pallat into two. There are alſo boſomes or cauities inſculped in this bone. On the outſide in the *wingy* proceſſes as hath bin ſaid: on the inſide one *anterior* & vpper which is tranſuerſe and long [tab,9,fig,10,at c] and prepareth a place for the coniunction of the optick nerues. Another *poſterior* & lovver almoſt foure ſquare, broad and ſmooth very like vnto a ſaddle. Hither the neck of the *Tunnell* reacheth, & in it the glandule vvhich receiueth the phlegme hath his abode, [ta.9,fig.10,r] out of vvhich the ſame moyſture flovveth aftervvard into the pallat and the noſthrils: for from this cauity or boſome, at the ſides on either hand do yſſue 2. canales very ſhallovv. His boſomes.

The vpper of theſe [ta.9,f,10,F] doth attain forward to his ſecond perforation, through which perforation the teares diſtil into the eyes, and the phlegme runneth either vnto the noſe or vnto the choppes through the fourth perforation; through the lower [ta.9,figu, 10,O] the phlegme is thought to diſtill into the chinke [ta,8,figu,9,N] which is ſeated betwixt the ſtony bone, the bones of the *Synciput* and the wedge bone, & from thence into the Pallat.

Cauities it hath, two at the ſides of the forenamed boſomes common with it to the Temple-bones and the bones of the *Synciput*; on the inſide concauous or hollow, on the outſide conuex or embowed. [ta.9,figu,10,ss] One alſo and that notable is in the *baſis* of this bone [tab,9.fig,10,vnder x] betwixt the ſurface which is toward the braine, and that which is toward the cauity of the mouth. This cauity in children is not found although the part be ſpongy for a whole yeare; in growne bodies it is hollow and skaley, ſometime not diſtinguiſhed, but ſpongy and made of diuers ſcales, ſometime it it is deuided into two diſtinct [ta,10,fig,12,E] cauities [ta,10,fig,12,cn] which are great or little according to the increment or groweth of the bones. This Cauity is couered with a fine and thin membrane, as thoſe cauities are which be in the forehead and in the cheekes. It is either empty (and therefore ſome haue thoght it was made for the voyce, and that the bones might be the lighter) or in it is contayned a viſcid or tough phlegme. Vnder theſe is another ſmall cauity ſundred into twayne by a partition: [ta,10,fig,12,o] and from the former cauity run two holes vnto the noſethrils, [figure,12,r] haply to giue entrance or entertainment to aire, although *Platerus* ſaith it containeth a medullous ſubſtance therein. It is couered on euery ſide with one continued ſcale, no where bored or hauing yſſue but into the capacity of the noſethrils: yet is this ſcale very thin, and may eaſily be bored through with a ſharpe poynted Probe. If in ſome bodies theſe cauities doe not appeare, then it is made within ſpongy or hollow like a Pumy Stone, ouer the ſurface of which porous ſubſtance are drawne continued ſcales. His cauities.

It hath ten perforations, ſome in the orbe of the Eye, others in the *Baſis* of the Scull. In the orbe of the Eye fiue, three proper and two common with the vpper Iaw. The firſt of theſe neare the proceſ- His perforations. 5. In the Orbe of the eye.

TABVLA. IX. *See this diſcription Tab.4.lib.7.fol.441.*

FIG. X.

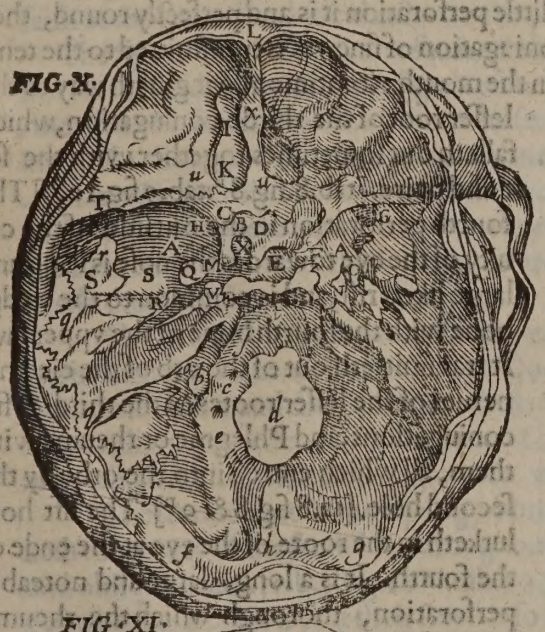
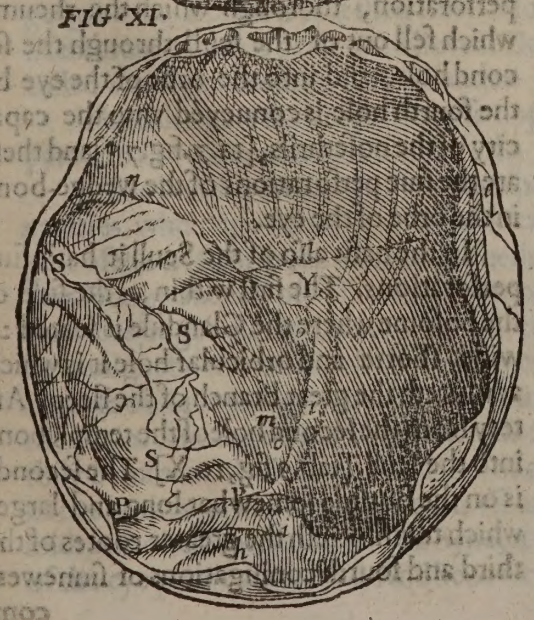


FIG. XI.



ſes which make the ſaddle, is circular or round [ta.8. fig.8. " ta.9.fig. 10 B] made for the tranſmiſſion of the Optick Nerues, and aboue in the outſide it hath as it were a litle angle [ta.9.f,10 C] through which paſſeth one ſmall veine vnto the eye. The ſecond perforation bored in the vpper part is not round but like a ſemi-circular cauity, a ſlit or a long cleft ending into an acute angle, [ta.8,fig.8 ° ta.9.fig.10 °] but the lower part of it is ſomwhat long and orbicular. And of this perforation *Bauhine* vnderſtandeth that of *Galen*, where he ſaith, That the wedge-bone is perforated like a Siue, as if his meaning were that this rift is like a Siue through which the Phlegm doth diſtil; and fitter it was ſaith *Galen* in the 11 *de vſu partium*, that it ſhoulde tranſcolate or diſtill then fall directly through: Otherwiſe we ſhould be continually ſpitting and muſt haue held our mouths open; and therefore herein *Veſalius* and *Columbus* were too apprehenſiue to finde fault with *Galen*, whereas indeede they are rather to bee found fault withall themſelues that they did not ſufficiently vnderſtand him, as we could make it manifeſt if it were a fit place to diſpute ſo nice queſtions in, but we follow our Hiſtory.

Galen redeemed.

Through this ſecond hole paſſeth the ſecond Coniugation of nerues vnto the muſcles of the eies which ariſe thereabout: alſo, the third paire or the leſſer part of the third coniugation which goeth vnto the skin of the forhead, to the muſcles of the cheekes & of the noſethrils; which yſſueth partly by the hole of the forhead bone aboue the inner angle of the eye, partly through the fourth hole; thirdly, a notable branch of the ſleepy Arterie; fourthly a veine entreth into the cauity of the forehead from the greater vein of the temples; fiftly thereby yſſue the watery humidities of the Braine which are gathered together in the glandule, of which teares are made, and thoſe get out of the cauity of the eye, from thence through the fourth perforation into the fifte, and from the fift they fall into the cauity of the noſethrils. And theſe are the vſes of the ſecond perforation. The third is immediately vnder the forenamed rift. A little perforation it is and perfectly round, thorough which the leſſer branch of the fift coniugation of ſinewes is tranſmitted to the temporall muſcle and to thoſe that lurke within the mouth: ſomtime alſo it giueth way to the leſſer roote of the thirde coniugation, which falleth out ſometimes together vvith the ſecond paire. [tab.8.fig.8 ": tab.9 fig.10,"] The fourth perforation in the outſide of the cauity of the eye towardes the noſe is long and large like a rift, and is common to the wedg-bone with the fourth bone of the vpper iaw. It tranſmitteth out of the orb of the eie ſmal nerues of the leſſer rootes of the third & fift coniugations, and Phlegme or rheume with them, all which entred into the orbe by the ſecond hole. [ta.8 fig.8 & 9 °] The fift hole lurketh in the roote of the eye at the ende of the fourth. It is a long, large and noteable perforation, thorough which the rheume which fell out of the ſcull through the ſecond hole, and into the orbe of the eye by the fourth hole, is conueyed vnto the capacity of the noſethrils, [ta.7.fig.7 *] and theſe are the fiue perforations of the wedge-bone in the orbe of the eye.

In the baſis alſo of the Scull it hath fiue perforations. The firſt within, at the ſide of the boſome where the Glandule is ſeated: a wide, ſhorte and orbiculat hole it is which admitteth the great branch of the ſleepy Artery from the ſecond hole of the temple bone into the ſcull. [tab.9 fig,10 X] The ſecond, is on the outſide ſomewhat long and large, which tranſmitteth the greater rootes of the third and fourth coniugations of ſinnewes,

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TABVLA X.

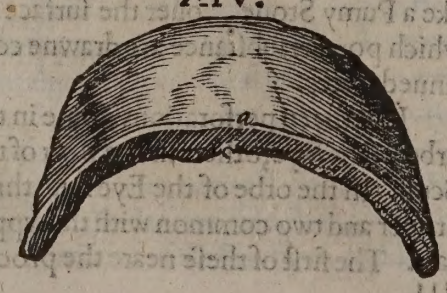
See this Table with his deſcription in fol. 443.

FIG XII

XIII

1. Out of the baſis of the ſcull.

XIV.



commonly so called. [tab.8.fig.9 ᵠ. ta.9,fig.10 ᵠ] The third adioyneth on the outside to the second, but is much lesse and round, made to admit the branch of the internal Iugular veine which entreth into the scull and into the substance of the *Dura Meninx*; [tab. 8. fig.4 ᴿ Tab.9.fig.10 ᴿ] sometime at the side of the sixt perforation wee finde small holes prepared to admit a branch of the foresaide Veine. [Tab.9.fig.10 ᴹ] The fourth is at the Nosethrils, a long hole and running directly outward, through which a braunch is conueyed into the cauity of the nosethrils [Tab.9.fig: 10 V] from the greater branch of the sleepy artery. The fift and last perforation of the wedge-bone is in the pallate at the extremity of the winged processe: it is large and almost oual, that through it the third coniugation of sinewes and the fourth might yssue: [ta.8.fig.9 ᵘᵘ] The third into the tongue and his coate to the teeth and the lips to giue them sense; the fourth to make the coate of the pallat. And thus much concerning the wedge-bone.

Of the Spongie Bone.

The second Bone that is common to the Head and the Iawe, which *Vesalius* and *Columbus* make the eight bone of the head, Anatomists haue called *Ethmoides* or the *Syue*, not because it is full of holes and dennes, but because these holes are not direct (though some direct there be) but curued or writhen as are the holes of a Sponge. It is more truly called *Spongoeides* or the Spongy-bone, which name *Hippocrates* gaue it, as *Galen* witnesseth in the 7 chap. of his 8 Booke *De vsu part.*

It is scituated in the forepart of the scull before the *Meninges* and filleth vp almost the whole cauity of the Nosethrils. It is ioyned to the middest of the forehead bone, [ta. 9. fig.10 ᴷ] and is distinguished on the backside from the wedge-bone by the ninth suture of the head, if that be not rather a harmony or Cœmentation then a suture [ta.9.fig. 10 aboue ᵘ] on the outside it determineth at the second Bone of the vpper iawe, *Columbus* saith at the second and the third. Situation.

The figure of it is like to that square that on one side is longer, on the other broader: but he that would see the true figure of the bone must take viewe of it in a childe but of one year old, for afterward it cannot be seuered from the rest of the bones without breaking. At that age also a man may perceiue how that which is accounted by *Vesalius* and *Archangelus* the third bone of the Iaw which maketh the thin but solide and plaine part of the orbe of the eye, and the Spongy bone of the nosethrilles which is oft eaten out by the French disease, and the Syue-bone are all parts of one and the same bone. For, indeede there are foure parts of this bone. Figure. 4 Partes.

The first is the vpper processe in the middle of the bone, long and triangular, ending in a sharpe point and resembling a Cockes-combe; sometimes it is thin and broad; sometime thicke and diuideth the whole bone like a partition: it distinguisheth also the Mammillary processes of the Braine. To this part also the third sinus of the *dura Meninx* which diuideth the Braine groweth very strongly [ta.9.fig:10 ᵃ ta.10.fi.12 ᴮ]

The second part of the Spongy-bone is on either side at the processe where it maketh the cauity of the scull. It is throughout perforated like a Syue with abundant, small and oblique holes. [tab.9.fig.10 ᴷ ᴷ.tab.10,fig.12 ᴬᴬ] In dogges these holes are much larger, whence haply it is that their smell is so briske and sharpe. It is compassed with a thin Membrane which is perforated like the Bone, and that indeed was the reason why it was called the Syue-bone or the Collander.

The third part is a lower processe opposite to the vpper which distinguisheth or separateth the vpper part of the nosethrils.

The fourth part and the last like a sponge or a *pumi* stone is porous and full of smal cauities, whereupon the whole Bone is called *spongoides*. This part is seated in the vpper part of the nosethrils, and accomplisheth or perfecteth the inside of the orbe of the eye. It is spongy and full of oblique perforations that the cold aire which we breath in, or impure aire might not insinuate it selfe directly into the Brain vnbroken or vnaltred, wherby it might be too much refrigerated or otherwayes annoyed; for being a while retained in these oblique passages it receiues a mutation, and is made more like to the temper of the Brain. And here *Galen* in the seuenth chap. of his eight Booke *de vsu part.* doth woorthily commend the infinite wisedome of our creator, who hath disposed of all the partes of our bodies, as was most fit for our vse and preseruation. This bone therefore is manifold: at the head perforated like a Syue, at the cauity of the nosethrils spongy, at the orbe of the eye plaine and broad. And hence it appeareth that the substance of this bone is ve- The wisdome of God.

ry thin thrilled, also manifould but finely and obliquely, finely or with a small bore least any thicke body that flies in the ayre should get into the brayne.

The vse of the perforations. The vse of the perforations is, sayth *Galen* in the sixt Chapter of his 8. boode *de vsu partium*, that through them the ayre might be breathed in for the generation of Animall spirites: againe, that with the ayre odours or sauours might ascend into the brayne, and therefore the Mammillary processes or the organs of Smelling doe runne out hard vnto these perforations: hence it is that those that be troubled with the *Coriza* (we call it commonly the *Pose*) cannot smell, because these perforations are stopped vp with Rheume. There is also good vse of them in diseases of the brayne, that the ayre being altered by medicines, and retayned longer in these cauities, might woorke more powerfully vppon the brayne.

Galen in the place last before quoted addeth another vse. By these perforations sayth he, when neede is, aboundance of excrements may be suddenly and togetherward auoyded: so likewise sayth *Laurentius*, but maketh it a secondary vse, yet *Platerus* denyeth that there can be any such confluence, vnlesse it be vnnaturall or beside nature.

Finally, in the backeside of this bone on either hand there is a semicircular rift or cleft, as if it were pinched with a mans nayles, which establisheth [ta. 9. fig. 10. below x] the *Dura mentnx* fastned thereto and perforated with diuers holes. And thus much concerning the spongy bone which is the last of the bones of the head or of the Scull. Now wee proceede vnto the bones of the Nose.

CHAP. VIII. *Of the Bones of the Nose and of the Yoke bone,*

THE Bones which make the cauity of the Nostrilles are of two sorts: some which may be sayde to bee proper to the Nose although indeede they bee bones of the vpper Iaw, others are common. The proper bones are three, two externall and the third internall, and these runne onely vnto the middle of the Nose, for the rest is altogether gristly.

The 2 externall bones. The two externall bones which make the rising bony part of the Nose are one on each side, small and quadrangular, but one side is longer then another. These are thin but very solid, perforated with small and common holes and are portions of the fist bone of the vpper Iaw, [ta. 8, fig. 8, ᴚᴚ] which portion aboue is ioyned in a short cut by the third common suture with the forehead bone betwixt the browes. [ta, 8, fig. 8, z y] At the sides they are vnited by a proper suture, *Archangelus* calleth it a *Harmony*, running along the side of the Nose [ta. 8. f. 8. from c tovvard y] vvith the 4 bone of the iavv [ta, 8, fig. 8, ᵃ f. 9, ˢ ʌ] which maketh the sides of the nostrils, the lower part of their holes, & the greatest part indeede of their capacity. Below they are vnited by gristles, wherfore at their end they are rough vnequall that the gristles and the bones might cleaue faster together. On the inside they are ioyned by another common line and cleaue fast vnto the partition of the *Syue-bone*.

The 3 internall. The third bone we sayd was inward within the cauity of the nostrilles: broad it is & thinne at the roote, but before and aboue thicke: it tendeth vpward to the holes of smelling and downeward to the Pallat. This is placed betweene the two former and adhereth, yea is vnited to a processe of the Syue-bone or the eight bone of the head. [ta, 9, fig 10. vnder x] It is called *Septum* or the partition, because it distinguisheth the cauity of the nostrilles into two parts. [ta, 8, fig, 8, O] It is ioyned to the two former or the fift bone of the iaw by the first internall suture. [ta, 8. fig, 8, vnder f] On the foreside it determineth into the middle gristle wherewith it is vnited. At the inner hollownes of the Nose toward the Pallat where this bone is seuered from the wedge-bone, it is deuided throughout his length by a broade rift, passeth throughout the Nose, and hauing his *Basis* which is thicke and broade bifurcated it lyeth vppon the wedge bone, resembleth the share of a Plough [tab, 8, fig, 9, c] and his edge is sinuated or vnequall. Finally, it is ioyned on the inside to the fourth & the sixt bones of the Iaw by the second internall suture. [ta, 8, fig, 8, g] These are those three we call the proper bones of the Nose.

The common bones. The common bones are, first that which we called the spongy bone which cleaueth to the top of the roote of the Nose, for in the inside of the Nose at this bone there are found two fungous and spungy portions which fil the vpper cauity of the nostrils, and are made to assist the voyce and the smelling. Their forme is very diuers, but they seeme to bee most like scales growing one vpon another. They are vnited with the Syue-bone, from whose

whose outward sides they yssue, so that sayth *Bauhine* for my part I beleeue that they arise from it and are parts thereof, although they do not grow to the partition. Againe they are vnited a good way in their sides to the forehead bone: on the inside they are so conioyned with the third bone of the Iawe, that *Falopius* hath referred this third bone of the iaw to the additaments of the Syue-bone and that not without good reason. In these the ayre which is drawne in together with odours receiues an alteration. They are vnequall and rough, that the excrement of the Nose should not perpetually distill downe, and in the French disease they are easily gnawne asunder.

Below at the pallat, the fourth bone of the Iaw [ta,8,fig,9,Λ] and the sixt [ta,8,fig,9, Π] together with his fellowe doe make the greatest part of the capacity of the nostrilles where they open backward into the Chops.

In a word this whole bony cauity of the nostrilles is formed of bones both on the inside and on the outside. Without, either before or at the sides, outwardly and before, aboue by the fourth [tab.8,fig,8,ª] and fift [Ξ] bones of the vpper iaw to which gristles are adioyned. Below at the pallat, by the fift [tab.8,fig,9,Λ] and the sixt. [Π] On the inside by the spongy bone of the head, [ta.9,fig,10.K] by the two spongy bones of the nostrilles, & by the partition of the nostrilles: [O] at the sides the cauity is made vp by the second, [tab, 8,fig.8.Δ] the third [Θ] and the fourth [from ˣ to ª] bones of the vpper iaw.

A briefe of the bones of the nose.

Of the Yoake-bone.

The Yoake-bone [tab.7.figur.6.ʸ ˣ] is called ζύγωμα, because it is made of two bones ioyned together. It is seated in the side of the face vnder the orbe of the eye. This is no peculiar bone though it haue a peculiar name, but is compounded of two processes of two seuerall bones: one of the Temple bone another of the first bone of the vpper iaw, which two processes are in the middest ioyned together by an oblique suture [ta.7.fig.6.ʸ table 8.figur.8.ʸ] and so make one bone like a yoake, although me thinks it is better compared to a bridge. On the outside it is gibbous, within hollow. The rootes on either side are thicke, but the middle of the processe which yssueth out of the Temple bone is but slender.

The yoake. bone.

The substance of it is hard and almost solid, almost I say, for it hath a cauity in it, such as it is, wherein it contayneth marrowe for his nourishment, yet is it somewhat solid too, the better to defend the Temporall muscle, especially his Tendon, before which it is placed, from outward iniuries: beside the muscle called *manserius* taketh his originall therefrom, and againe it strengthneth the Scull which is there but thinne. And finally sayeth *Platerus* and with him *Laurentius*, it giueth a great strength vnto the orb of the eye which swelleth out a little aboue it. And so much of the yoake-bone: now we proceede vnto the vpper Iaw.

His substãce,

CHAP. IX. *Of the sutures and Seames of the vpper Iaw.*

THE Iaw is called by *Aristotle* σιαγών, because when we hould our Iawes together wee keepe silence, which the Grecians call σιγᾶν, it is also called γένυς, because there the beard doeth first flourish or breake out. The Iaw is double, the vpper and the lower, called by *Hippocrates* and *Galen* ἄνω and κάτω γένυς.

The vpper Iaw is the bony part of the Face, which maketh the lower part of the orbe of the Eye and the sides, the cauity of the Nostrils, the Cheeks, the Pallat & containeth the vpper rowes of the Teeth.

The diuision of the face,

This vpper Iaw is to bee considered either whole or according to his parts of which he is compounded.

In the whole Iaw wee consider his conformation and his connexion which is made by sutures. In the consideration of the partes wee will examine the bones whereof it is compounded. The conformation of the whole Iaw is diuers, broade aboue and narrow below, because of the protuberations, perforations and cauities which are therein.

The prominences or protuberations are aboue in the middle of the face where the Nose is formed, [tab.8.figure.8.ᶠ] which is peculiar onely to man, for onely a mans Nose swelleth out or standeth off from his Face. At the sides it swelleth on both handes, at the Temples to make the lower edge or verge of the Eyes and of the Cheekes [table 8.

The protuberations of the vpper iaw.

fig.8 aboue r] although it alſo make the lower cauity of the eyes. Below on the outſide, wher the roots of the teeth are it buncheth circularly: [vnder ʌ] within it maketh the anterior and greater part of the pallat which is rough, [tab.8.fig.9 t y z] and in the circumference it protuberateth for the dens or ſockets of the teeth. [fig,9 u u]

The perforations. The perforations are partly ſmall, through which the veines, arteries, and nerues are tranſmitted, as ſhall be ſaide in the Hiſtory of the particular Bones; partly great, two in the lower cauity of the eyes, as in the ſecond bone [fig.8 C] through which the rheume falleth and a ſmall Nerue vnto the noſethrilles; and in the fourth through which a little nerue runneth to the outſide of the cheekes. So alſo in the foreſide of the Plate and in the middeſt thereof one perforation which admitteth a ſmall veine and a little Artery [fig,9, z] and on the backſide of the palate two on either hand which run vnto the ſides of the noſethrils. [at V]

The cauities. The Cauities are Proper and Common. Proper to the fourth bone wherein there is a den cloſed vp within the bone at the ſides of the noſethrils [fig.8 vnder x y] & the ſockets made to receiue the teeth, of which we ſhall ſpeak in the deſcriptions of the fourth bone. The Common cauity is that of the noſethrils, diſtinguiſhed by the partition and filled aboue with the ſpongy bones, which cauity both outwardly in the noſe [figu.8 OO] and inwardly in the mouth [figu.9 at qq] is alwayes open, that the ayre in expiration may returne backeward, and in ſmelling bee drawne vpwarde, and Rheume be that way euacuated.

Why the crocodiles vpper iawe is immoueable. This vpper iaw in all creatures is immooueable excepting the water Crocodile, of which, ſaith *Archangelus*, there can be no particular reaſon giuen. A common Reaſon he giueth out of *Ariſtotle* where he ſaith, that the Body is the Inſtrument of the Soule, & therefore Nature hath accommodated the body and ſo furniſhed it as it wee ſee for the behoofe of the Soule in Men, in Oxen, in Horſes, yea and in the Crocodile too, whoſe ſoule hath ſome poure or faculty to vs vnknowne, but expreſſed by the motion of the vpper Iaw; but his nether iawe is ſo vnited with the Temple-bones that it cannot at all bee mooued, becauſe it is faſtned into 2 boſomes, whereas the vpper is articulated on eyther ſide with a broad head. Yet *Ariſtotle* ſaith, that his vpper iaw was made mooueable to recompence the defect of his feete, becauſe they are little, and vnfit either to catch or to reteine his prey.

In a Parrat or Poppingey both iawes are mooueable, and he moueth them either one at once or both together as he liſteth. In a man the vpper iaw is immoueable, firſt, becauſe the motion thereof would haue hindred his ſight. Againe, in receiuing of Odours and inſpiration of aire the motion of the vpper iawe would haue made an interruption. Thirdly, hard meats could not haue bene ſo well broken; for as in a Mill where Corne is ground one ſtone muſt reſt immoueable the other muſt run vppon it, ſo in the grinding or breaking of meate it was neceſſary that one part which is the vpper iaw ſhould be immoueable, the other which is the lower iaw moueable.

Why a mans immoueable.

Heereto we may add, that the immobility of the vpper iaw is a beauty to the face, for if it had bene moued then it muſt neceſſarily haue bene corrugated or contracted, and ſo the elegancy and forme of the face bene deformed, whereas in the frame of mans bodye our Wiſe Creator had an eſpeciall reſpect to make the face beautifull, becauſe it is the image of the ſoule; wherfore a mans face is not ſet off from his head as in brute beaſts, but made ſhort and round for beauty and better forme.

Connexion. The vpper iaw is faſtned either with the bones that are about it, or with the proper bones of which it is compounded; which connexion is made by immouable commiſſure or coniunction, and that partly by ſutures or ſeames, partly by *Harmony* or *Cæmentation*. Of theſe Sutures or commiſſures ſome are common vnto the ſcull with the bones of the vpper iaw, and thoſe are fiue, of which we ſpake before in the fift chapt. Others are proper to the bones of the iaw and are nine in number, and ioyne together twelue bones of the iaw, ſome of theſe, that is, two, are in the cauity of the noſethrils, the other ſeauen are on the outſide. Againe of theſe ſeuen fiue are common to two bones of the iawe ioyning together, and two are peculiar to one bone. Of theſe in order.

The firſt internall future. The firſt internall future we meet withall in the cauity of the noſethrils, & it is common to the partition and the fift bone. His courſe is ſhort and obliquely downward. [tab 8.fig,8 vnder f] The ſecond is alſo found thereabout and is common to the partition of the noſethrils and the fourth and ſixt bones of the iaw, his courſe is ſomewhat longer and forward,

forward, but ouerthwart [Tab.8.fig.8 g]

The first externall future runneth obliquely to the cheeke-bone, and of it there are three parts, the first runneth through the cauities of the Temple bones outwarde and downward to the lower side of the cheeke: the second through the foreside of the cheek vpward and inward to the middle part of the eye. [Tab. 8. fig.8 from *a* vnto the lower D] The third in the cauity of the eye; it runneth backward and outward [From the lower *b* to *c*] and determineth at the second future which is common also to the scull. This first externall future is common to the first bone and the fourth. The first externall.

The second externall future runneth circularly in the orbe of the eye aboue the compasse of his bone; it beginneth at the third common future and runneth downward, then presently forward, and again from thence vpward. This future is common to the second bone with the third on the backside, and to the fourth bone on the outwarde and lower side. [tab.8.fig.8 from V to *i*. from thence to C and Δ]

The third is also in the orbe of the eie, and runneth directly outward from that future which is called the second common future of the wedgebone, and determineth in the second future; it is common to the third and fourth bone. [ta.6.fig.8 from *d* to *e*]

The fourth is at the outside of the nosethrils, and runneth from the third common future directly downward throughout the length of the fist bone as far as to the gristle, and this is common to the fourth bone and the fift. [Tab.8 fig.8 from *z* to *s*]

The fift is in the pallat and runneth ouerthwart through the backside therof, & it is common to the fourth bone with the sixt. [tab.8 fig.9 *t u*]

The sixt is in the vpper part of the nose, and runneth from the middle of the Browes, where the third common future is, directly throughout the length of the nose, and distinguisheth the fift bone through the middest.

The seauenth is in the pallate, a line rather then a future; so also is the sixte saith *Columbus*, it runneth directly through the whole length of the Pallate, and is verie conspicuous both vvithin and vvithout the Nosethrilles, and diuideth thorough the middest the fourth bone and the sixt. [tab.8.fig.9, *y t x*] So also in the forepart of the iawe it runneth from the cauity through the middest of the *shearing*-teeth directly downward vnto the pallat, [tab.8, figu. 8 *h*] but in Dogges, Apes, and Swine, and those creatures whose Dog-teeth are strong and hang ouer the iaw we meete, saith *Vesalius*, with two sutures or Harmonies which are not to be found in a man, and therefore they haue peculiar bones in which the Shearing-teeth are fastned.

There are also certaine Bastard Sutures which do not quite diuide the bone but are rather lines or inscriptions and are onely founde in the fourth bone: first in the lower part of the orbe of the eye which runneth from the first perforation obliquely vnto the compasse of the eye but no further, and diuideth the fourth bone betweene the vpper seate of the first perforation and the circumference of the eye. [Tab.8.fig.8 *i*] Againe, in the forepart of the palat runneth a line obliquely from the second perforation of the fourth bone vnto the *Dog-teeth*. The Bastard Sutures.

This saith *Columbus* in children is very manifest, but in growne bodies there remayneth no signe or footestep thereof. Heereto opposeth *Falopius* in his Obseruations where he saith, I discent from them who say there is a future found attaining ouerthwart vnder the pallat to the Dog-teeth on either side, which in children should be conspicuous, but in growne bodies is obliterated. For I finde saith he, that this is a diuision or a riste rather then a future, because it doth not separate one bone from another nor appear on the outside: for how can it be a kind of articulation if it do not ioyne one bone with another. Moreouer, I cannot bee perswaded that this diuision, such as it is, is more conspicuous in children then in growne bodies, for I finde it very seldome obliterated and that in verie old men. Disagreemẽt betwixt *Falopius* and *Col.*

Thus farre *Falopius*. *Bauhine* addeth, that although in men it doe not diuide the Bone throughout, yet in Dogs, Apes and Hogs it doth, in which creatures it doth not only diuide the fourth bone in the palat, but also on the outside in the forepart of the iaw.

CHAP. X. *Of the Bones of the vpper Iaw.*

THE vpper iaw doth not consist of one Bone but of many, not only to make it fitter to repell iniuries, but also and especially that out of their Commissures and coniunctions might yssue Ligaments to make vp the construction or frame of the Muscles, which by that meanes are more firmly fastned

to

to their originals as to bony parts and therby made the ſtronger. Beſide, it was not fit that the vpper law ſhould be on euery ſide a like thicke or harde, or faſt or ſoft. The bones therefore of the vpper iaw are of two ſorts, Common and Proper.

The common bones of the Iaw.

The Common Bones are the VVedge and Spongy bones called alſo the ſeuenth and the eight bones of the head. From this eight bone do yſſue two ſpongy bones ſeated in the inſide of the noſe, which diſtinguiſh the vpper part into two ſides, to theſe are ioyned other two which make vp the inner orbe of the eye, which alſo wee will account, as other men do, for the third bone of the Iaw. But of theſe wee haue partly ſpoken before in the ſeuenth chapter among the bones of the Head, partly in the eight amongeſt the bones of the Noſe, and therefore we will come now vnto the proper Bones of the Iaw.

The proper bones. First.

The proper bones of the iaw which helpe to make the face are twelue. The firſt [ta. 8. figure 8. Γ r] maketh a good part of the Cheeke, the lower part of the eye to wardes the Temples, that round extuberation which *Hippocrates* calleth κύκλον προσώπου the circle of the countenance, one part of the yoake-bone, a litle of the temples and the vtter angle of the eye. The figure of it ſaith *Columbus* is diuers: *Bauhine* ſaith it is triangular, ſending forth of a broad middle three protuberations; one to the angle of the eie, another to the teeth, and a third which is moſt notable, that is, the proceſſe which maketh a part of the yoke-bone, [tab 8.fig.9 ˣ with ˣ] and hauing a perforation or two but verie ſmall ones.

This firſt bone is ioyned to foure bones: aboue, to the forehead bone where the eye-browes end by the firſt [tab.7.fig.6 & 7 ᴮ] common ſuture: [tab.8.fig.8 ᴿ] behind, to the wedge-bone by the ſecond common ſuture: [tab.8.figu.8 from S to ☜] at the ſides, it is ioyned by his proceſſe to the proceſſe of the Temple bones by the fourth common Oblique ſuture: [tab.8.fig.8 ᴾ] below, to the fourth Bone of the vpper iaw neere the cheeke, and in the lower part of the orbe of the eye. [tab.8.fig.8. from the lower D by the vpper D vnto ☜]

Second.

The ſecond bone [tab.8.fig.8 △] ſtandeth in the great angle of the eye neere the Noſe, and iuſt at the beginning of the angle where the hole goes into the noſethrils [t.8.fi.8, C] wee meete alſo with a caruncle which like a glandule receiueth the Phlegme which floweth from the Braine vnto the eye to deriue it vnto the noſethrilles that it ſhoulde not fall downe the cheekes. *Galen* alſo addeth, that Medicines which are put into the eyes, doe vſe to yſſue out of the noſethrils, whereat *Columbus* much maruelled, becauſe ſuch medicines muſt penetrate the Membrane before they can get into the noſe.

This is a ſmall bone, thin as a ſcale and tranſparant, and becauſe it hangeth but looſely, as being rather ioyned by harmony then by ſuture, to the outſide of the fourth bone, it is eaſily broken and loſt, and therefore we rarely meete with it in the ſculles digged out of the earth, for being and in a moyſt place it eaſily putrifieth; but in thoſe ſculs that are boiled it is eaſily preſerued. It is ioyned to three bones: aboue, to the forehead bone by the third common ſuture: [tab. 8.fig.8 nere v] behind, to the third bone of the iaw by the ſecond externall ſuture; [from V to V] before and below to the fourth of the iawe by the ſame ſuture: [from C toward x] ſomtimes alſo it is ioyned vnto the ſpongy-bones of the Noſe. And this is the place where thoſe Apoſtemations are which the Græcians call αἰγίλωπας, which if they be neglected do penetrate to the mouth, and do end into *weeping Fiſtulaes*. This bone alſo hath ſome perforations; aboue ſome ſmall ones which are common; one alſo very notable which is cõmon to it with the fourth bone, [t.8.f.8 C] which runneth out of the inner angle of the eye directly downward into the cauity of the Noſethrils: the vſe of it is to tranſmit a ſmal portion of the leſſer roote, commonly ſo called, of the third coniugation, and alſo Rheume or Phlegme.

Aegilops.

Weeping Fiſtulaes.

The third Bone which we ſaide was the fourth part of the Spongy-bone, [tab.8.f.8 ⊙] but is by moſt made the third of the vpper iaw, is ſeated in the inner ſide of the eye, and within is continuall with the fungous bones of the Noſethrils. This is broader then the ſecond, quadrangular but ſomwhat round, thin & tranſparant like the ſcale of a fiſh; with out ſmooth, within rugged and vnequall, becauſe of the ſcales that cleaue vnto it: & if you breake it, within you ſhall finde large cauities filled with aire.

Third.

It is ioyned to foure bones. Aboue to the forehead bone by the third common ſuture, & there is a good length off the ſuture between them. [t.8.fig 8 from ᵀ toward ᵛ] Behind, to the wedge-bone by the ſame ſuture, but the length of it is leſſer. Before, with the ſecond Bone of the iaw by the ſecond ſuture. [from V to ᶜ] Belowe, to the fourth bone of the iaw by the third ſuture. [from ᶜ to ᵇ]

The

The fourth bone [tab.8.fig.8.ΛΛ] maketh for the most part the forepart of the nose-thrils and of the mouth, into which al the vpper Teeth are infixed, also the sides and lower part of the pallat and of the holes of the nostrilles; yea and beside the lower part of the orbe of the eye toward the Nose. *Galen* calleth it *Os malæ* the Cheek bone, and he saith it deserueth well to be called by the name of the whole, the vpper Iaw. It is much larger then any other of the bones, and is circumscribed with many sutures, for it abutteth vpon seauentéene bones if you reckon the Teeth. Aboue neare the Nose it is ioyned to the forehead bone (yet but a little way) by the third common suture. [ta.8.fig.8.[x] [x]] Below to the wedge bone by the second common suture [ta.8.fig.8.from [p] to [n] fig.9.from [d] to [e]] where also the vpper part of the wedge bone and the iaw doe yawne into the orbe of the Eye. The fourth. His connexions.

It is also ioyned with other bones of the vpper iaw: as to the first by the first oblique suture [tab.7.fig.6.[ab] [a]] in the Cheeke, the orbe of the Eye and the cauities of the Temples. Before to the second in the inner angle of the eye by the second suture. [ta.8, fig.8, from C toward X] Behinde to the third by the third suture. [from [b] to [e]] On the outside to the fift bone in the top of the Nose by the fourth suture: [[e] [r]] to the sixt in the Pallat by the fift suture; [ta,8,fig.9.[n]] and finally to his owne companion by the seauenth suture, or rather by a line, partly in the forepart of the iaw [tab.8.figu.8.[h]] where the furrow is of the vpper Lip, partly in the pallat [tab.8.fig.9.[xy]] Into this fourth bone also are the vpper Teeth fastened by *Gomphosis* or way of *Mortize*, and it is vnited vnto the Gristles of the Nose.

It hath also perforations and dennes. The perforations are Common and Proper: one Common which is very small toward the inner angle of the Eye. The Proper are 3. two in the lower part of the Eye, on each side one, which is onely couered with a bony scale, and runeth from the lower part of the Eye outward: his vse is to transmit a surcle of the lesser roote, commonly so called, of the third coniugation of sinnewes out of the orbe of the eye into the Face. [ta.8.fig.8.at [s]] Perforations.

The third hole is in the Pallate at the backepart of the *Shearing* or shredding Teeth, where both bones of the iaw do meete. [ta.8.fig.9.[z]] It runneth out of the Pallat into the capacity of the Nostrilles, and transmitteth a small veine and a small artery vnto the nose; and at the sides hereof there appeareth a suture in young children.

The dennes or cauities of this fourth bone are of two sorts; of the first is one on each side at the lower sides of the cauity of the nostrilles vnder the orbe of the Eye. It is a great cauity, and so large sometimes that in it a man may lay his thumbe end: and therefore it may well be likened to those hollow images made of molten waxe: yet is it couered with an attenuated bone, blowne vp as it were round, [ta.8.fig.8.vnder [δ] [λ]] which was made partly because of the leuity of the bones, which in this place stoode in neede to bee thicke by reason of the situation of the eyes, partly because it is most fitte to forme the voyce, so sayth *Vesalius*. Cauities.

This cauity is not to be found in young children, but is made as they grow, and is inuested with a very fine coate, it is also found full of mucous or slimy phlegme, or marrow saith *Archangelus*, whereby the bones that containe the Teeth and all the vpper Teeth also are nourished. Of the second kinde of dennes of this fourth bone, are the sockets or mortizes of the Teeth which are insculped in the lower brinke thereof, in which the teeth are fastned. [ta.8.fig.8.vnder [h].]

The fift bone of the vpper Iaw, [ta.8.fig.8.[ϖ] [ϖ]] which with his companion maketh the bony prominence of the Nosei, s a small bone and almost quadrangular, but somewhat long, yet shorter by farre in a man then either in Dogges or in Apes. It is a hard, solid, broade and thinne bone hauing smal common perforations in it. It is ioyned aboue to the forehead bone by the third common suture; [tab.8.fig.8.[yz]] againe in the sides to the first bone of the iaw on either hand, and outward to the fourth bone by the third proper suture, [fig8.from [e] to [x]] and in the middle it is ioyned to his companion by the sixt suture [fig 8.from [z] to [f]] which is not much vnlike a harmony, and runneth directly from the suture of the forehead throughout the length of the bones of the Nose. Below it hath no suture but is rough and vnequall that the gristles of the Nose might take better hold vpon it. On the inside where these two bones are ioyned, they adhere to the bony partition vnder them, and that cleaueth to the spongy bone. The fift.

The sixt and last bone of the vpper Iaw (for you must reckon euery one of these dou- The sixt

ble,

ble, one on one side, another on another) [ta.8.fi.9, n] is placed at the end of the pallate, where the nosethrils do determine into the chops and maketh together with his companion the backpart of the circumference of the nosethrils and the pallat. It is a broad bone thin and solid, and in the end where it is rough it resembleth a semi-circle. [tab.8.fig.9 aboue q] It is ioyned behinde, to the wedge-bone at his wingy processes: belowe, and on the outside by a part [q] of the second common suture. On the inside to the partition of the nosethrils by the second externall suture: [tab.8.fig.8 s] againe, to the fourth Bone of the iaw by the fift transuerse suture; [fig.9 t] and finally, to his companion in the backe-part in the pallate by the sixte suture running along the length of the pallat [tab.8.figu.9. from *t* to *x*]

The perforations.

It hath two perforations on either side, one large which runneth vpward and backward to the ninth common hole of the wedge-bone, [tab.8.fig.9. a little below μ] the other small, which sometime determineth into the former, somtime into the second common suture. [aboue q at r]

CHAP. XL. *Of the lower Iaw.*

The Lower Iaw

THe lower Iaw, which the interpreter of *Halliabba* calleth *Faucem* [tab.11.fig. 1 & 2] maketh the lower part of the capacity of the mouth, into it the teeth are infixed and it is articulated to the scull. In men it is mooueable and by it they chew their meate for, becausе the teeth must grind and cut that which is eaten, it was necessary that the vpper teeth should depart from the lower and returne againe vnto them. And becausе in the descent it needed no strength, but in the ascent very great strength, as well to lift vp the weight of the bone as to breake the meate, therefore it is depressed by weake muscles, but lifted vp by exceeding stronge as we haue shewed before in the 10 booke. This iaw in a man is shorter then in anie other creature proportionably. It is almost orbicular becausе of the roundnes of his face wherin is his beauty. In other creatures, saith *Galen* (excepting an Ape, whose face and hands are much like vnto a mans) the iawes are long and prominent, becausе they vse them instead of hands, and becausе they were to be enclined to the earth to gather their foode.

His Figure.

The figure of it is like a bow, the belly hollow for lightnesse, and that it might not offend the muscles which mooue it. Before, in the top of the chin it is broade and thicke, in other creatures it is narrow and prominent. Behinde it is parted, partly that the passage of the meate should not be hindred, partly that it might more commodiously for motion be articulated to the scull on either side.

Processes.

For it hath on the backside on either hand two processes (some call them Hornes) which run vpward. One turned backward, [Tab.11.fig.1 & 2 C] broad and thin, ending into a cone or point called κορώνη which receiueth the tendon of the temporall Muscle; for that tendon compasseth it round about, and is very strongly implanted thereinto; & hence haply it was, that *Hippocrates* saith, the luxation of the lower iawe is most-what mortall, becausе of the distention and alteration of the temporall muscle.

The other and the backer processe is called κονδυλώδης and is like a knot. It runneth backward, hauing a long prominent head and transuerse, [fig.1 & 2 A] whereunder there is a notable necke. [B] By this head it is articulated into a cauity on either side answereable thereto insculped in the Temple-bone, which articulation is made betwixt the root of the yoake-bone and the Hole of Hearing. By this articulation the iaw is mooued vpward to the scull, downward also and somewhat to the sides: ouer the heade, as also ouer the sinus there is a gristle couering them like a crust.

But besides this which is common to all ioyntes, there is another gristle reposed betwixt the bosome and the head which is smooth, thin and soft, doing not onely the office of a Ligament to conteine the processe within his cauity, but also it maketh the motion of the ioynt more glibbe and slipping. Moreouer, togither with the other gristles in the strong and perpetuall motions of the iaw it keepeth the bones from breaking, at lest from wearing one against another.

This ioynt also of the lower iaw with the Temple-bones is couered with a common Membranous Ligament. On the backside on either hand where it shooteth out his processes [fig.1 and 2 EE] it is exasperated with small protuberations like litle rising hillocks especially where it is broadest behinde and below. Before and on the inside in the middle of the chin there riseth a bunch vp, [fig.2 H] made for the stronger insertion of the pro-

per

TABVLA XI.

Tab. II. sheweth the lower iaw together with the teeth in the first and second figures. The third figure sheweth the Teeth by themselues.

A. The head of the iaw wher it is articulated vnto the Temple-bones.
B. The necke of the Head.
C. The processe into which the Temporall Muscle is inserted.
D. A Bosome or cauity giuing way to the third muscle of the lower iaw
E, A roughnesse into which is inserted the muscle called *Mansorius*.
F. The inner perforation.
G. The vtter perforation.
H. Asperities into which the Muscles are implanted.

Third Figure.

AA. Eight vpper Teeth.
BB. Eight lower teeth.
C. The basis or bottome of a *grinding*-tooth called *Molaris*.
D. The basis or bottome of a *shearing-tooth* called *Incisorius*.
E. The Cauitie that is in the grinding teeth when they are broken.

per muscles by which it is led downward, as also to giue a more commodious originall to some muscles of the tongue; for where the place is rough and vnequal there the muscles will cleaue the faster. In like manner also is it exasperated on the outside at the toppe of the chin, [tab. II. figu. I vnder *] that the Muscles of the lower lippe might better arise therefrom.

The Bosomes.

At the sides of the processes it hath superficiary or shallowe bosomes, yet so that it is more hollowed on the inside then on the outside. VVithout on each side one, and that large; [fig. I betwixt BC] within two distinguished by a certaine knot. [fig. 2 neere D B] The anterior at the roots of the teeth was made to giue way to the gummes, the posterior and the larger affordeth a seate vnto the muscle that *turketh in the mouth*, that his thickenesse and bulke should not fill vp the narrownesse of the chops.

The composition of it.

It is compounded of two bones, for in infants the two bones are very manifest, ioyned together in the middle of the chin by a plentifull gristle, so that in some bodies at seuen yeares of age, the markes or footsteps thereof doe remaine, but in grown bodies the gristle is chaunged into the nature of a bone, and those two bones are so strictly vnited, that there doth not appeare so much as any shew of a line betwixt them, neyther can they be separated by boyling, by putrifaction, or by any strength, which is the reason why *Vesalius* concludeth it to be but one bone. For, saith he, although in young children it be formed of two bones vnited together, yet we cannot simply say that the lower iaw consisteth of two bones, vnlesse we will also say, that the Nowle-bone, the *vertebræ* or rack-bones and the bones that are ioyned vnto the sides of the Holy-bone bee made of many bones, for in children euen these are built vp of many bones.

Vesalius.

Falopius

Falopius makes answere, if *Vesalius* say wee may not make denomination from imperfect partes, then certainly all Anatomistes haue erred who speake so much of Appendances: for they are found onely in imperfect bones, not after the body is growne: but to proceede.

The Line which we see in the iaw of a childe is insteade of a suture, that out of it the Ligaments might be produced which goe into the muscles of that place. In Dogs, Oxen, Asses, and many other creatures, these two bones may easily bee parted without coction or any great violence.

Why it is hard. The bone of the lower iaw is very hard, and for the most part solide to make it the stronger; not because it alone was moueable, but because it was to endure diuers & those very violent motions in biting and chewing: within it is excauated that the weight thereof should not be offensiue or hinder the muscles that moue it.

Cauities. It hath also cauities to contayne the marrow which is his nourishment, which are not exsculped or grauen in the backepart of the iaw as in bruite beasts, but more forward toward the Region of the Chinne and the sides of the iaw vnder the sockets of the teeth, and therefore about these places it is thicker, as it is thinner toward the backpart.

For that the lower iaw is made thicker by reason of the teeth that were to be fastned therein hence it appeareth, because in old bodies and those who haue lost their Teeth, or where the sockets of the teeth are grown vp; in such bodies I say the iaw groweth much thinner and narrower from below vpward. These sockets, or beds, or mortize holes, or what you list to call them, wherein the Teeth are infixed, are engrauen in the embowed compasse of the iaw.

Perforations. Perforations also it hath on either side tvvo, vvhich runne through rhe iavv like a Canale or pipe; for put a bristle into the hole of a iavv vvhen it is drye on the inside and you shall easily thrust it through the hole on the outside, and if you breake the iavv in sunder you shall finde that the vvay betvvixt the outvvard and invvard hole is continuall and formed round like a canale. The one of these perforations is inner and backer at the internall bosome not farre from the processes.

It is on each side one, and greater then the other, vnequal also or rough beginning like a scale, [tab. 11. fig. 2 r] and through it a portion of the third coniugation of nerues is dispersed vnto the roots of the Teeth (together vvith a small veine and artery) vvhich sendeth small surcles to the teeth and to the iaw.

The other perforation is small and round, grauen or thrilled without at the sides of the chinne, [ta. 11. fig. 1. at e on either side] and by it the foresaid nerues being now within, doe againe returne out of the iaw outward into the lower lip, and this second perforation is far lesser then the first.

CHAP. XII. *Of the Sockets of the Teeth.*

The sockets of the teeth. IN the circumference or margent of both the Iawes, which place *Galen* called ὀδόντια, we meete with certaine cauities or hollow places which the Latines call *Alueoli* or *Locelli*. They are digged deepe that the Teeth like so many nayles might be firmlier fastned in them by *Gomphosis* or by way of Mortize; and therefore the rootes of the teeth are made iust fitte and answerable to the holes of the Iaw, for if they had bin broader the composition would haue beene too dissolute, and if they had beene too narrow the rootes of the teeth would not haue attayned to their bottomes, but being fitte as they are they are very firmely conteined. The number of these sockets can hardly be assigned, because they are sometimes single, sometimes double, sometimes treble, according to the variety of the roots of the Teeth.

Moreouer, although they be bony, yet they appeare to be almost like wax, and may well be compared to the holes of a hony combe which are often obliterated and often againe renued: for when a Tooth is drawne, vnlesse a new one grow vp, the hole is so constringed that there remayneth no print thereof: yea if a Tooth fall out and a newe one doe rise vp in his roome, the former socket is obliterated and a newe one grauen for the new Tooth.

The Formatiue faculty remaines in the teeth. Hence *Falopius* concludeth, that the liuely and quickning Formatiue faculty remaineth in the Teeth vnto the period of a mans life, for by it they encrease and receiue their forme. So in the Cheekes and the Iaw when those Teeth which wee cal *Genuini dentes* or *dentes sapientiæ* doe shoote out, haply about seauenty yeares of age, yet euen then new soc-

ſockets are made for them. Againe at foureſcore when the teeth fall, the ſockets grow vp and the iaw in that part is ſo compreſſed that the bone on euery ſide cleaueth together, & at length is vnited. For the ſockets are not onely filled with a bony ſubſtance and rammed vp, but each partition growing to other do make a ſharpe edge which in olde men ſerueth in ſtead of teeth, if not to cut yet ſomewhat to breake and chew their meat. And ſo much of the Sockets, now we come to the Teeth themſelues.

CHAP. XIII. *Of the name, definition, figure, magnitude, number, ſite and articulation of the Teeth.*

THE Teeth are called in Greeke ὀδόντες, as it were ἔδοντες of ἔδω, which ſignifieth to eate. In like manner the Latines call them *Dentes quaſi edentes* of eating. They are the hardeſt of all the bones, hollow within, hauing ſmall veynes, arteries, and nerues; articulated to the ſockets or deuis of their owne iaw *Per Gomphoſin*, or by way of mortize, faſtened with membranes, & fleſh, or ligaments, & prim arily created for the comminution or mitigation or chewing of the meate. Their names.

That they are bones ſome men do deny, firſt becauſe bones are inſenſible the teeh ſenſible. Secondly, becauſe the bones haue certaine limits of auction or increaſe, neyther do they euer grow againe if they periſh, but in teeth it is quite contrary. Thirdly, becauſe they are harder then other bones. Fourthly, becauſe bones expoſed to the ayre do grow blacke, whereas the teeth keepe their whiteneſſe. Fiftly, they ſay, that *Hippocrates* in the 18 Aphoriſme of the fift ſection diſtinguiſheth them from bones where he ſaith, that cold things are enemies to the teeth, to the bones, and to the nerues. Finally, ſay they, there is a ſtone that will conſume fleſh called therefore *Sarcophagus*, which within forty dayes will deuoure the whole body except the teeth. If therefore the teeth were of the nature of bones they alſo would be conſumed. Arguments that teeth are no bones.

We anſwere to the firſt, that ſenſe is not of the nature of a bone. To the ſeconde, that they grow becauſe in attrition they are worne. To the third, that *more or leſſe* do not change the ſpecies or kind, otherwiſe the ſpongy bones ſhold be no bones. To the fourth, that they are accuſtomed to the outward aer and haue no perioſtion on them, and the Philoſopher ſaith, that that which is accuſtomable maketh no impreſsion or alteration. To the fift, that is, to *Hippocrates* authority we ſay, that the bones and the teeth are affected by cold diuerſly; the bones onely by ſuffering, the teeth not onely by ſuffering but alſo by ſenſation. To the ſixt, firſt we may ſafely doubt of the experience; ſecondly, we may ſay that the Teeth are not conſumed becauſe they are harder then other bones. Answered.

It remaineth therefore according to *Hippocrates*, *Ariſtotle*, and *Galen*, that the Teeth are bones, for ſaith *Galen* they cannot be referred to any other ſimilar part, and therfore he placeth the teeth vnder the common *Genus* of the bones, and the rather becauſe the qualities of their matter do agree, as hardneſſe, ſolidity, ſmoothnes, whiteneſſe, &c. yet there are ſome differences betwixt them and other bones. For among all the bones none but theſe haue any exquiſite ſence becauſe the teeth alone do admit nerues into their cauitie.

The teeth alone do increaſe as the life increaſeth, that without any detriment they might performe their offices: for being worne in the chewing of meates they are increaſed againe, but onely ſo much as they are worne away, otherwiſe they would ſoone fayle. The other bones haue no ſence or but obſcure, neither do they increaſe alwayes but when they come vnto their ſtate or perfection they make a ſtay becauſe they are not changed in the performance of their functions.

They differ alſo from bones becauſe they are naked hauing no perioſtion without the, for then they would be payned in the wearing; hence it was that *Ariſtotle* doth oftentimes not number the teeth among the bones, but ſometimes ſaith they are bony, ſomtimes that they reſemble the nature of bones. And truly in their hardneſſe, faſtneſſe, or ſolidity they doe exceed other bones, yea they are little ſofter then ſtones themſelues, if they bee not allout ſo hard eſpecially about their extremities. Some are ſtony like a milſtone, others are ſharpe like the ſteeld edge of a knife. They were made very hard that they might not weare ſo ſoone or be broken in the chawing or breaking of hard things, for they are not lined eyther with fatte or griſtles as other ioynts are to hinder attrition. The teeth therefore do breake bones, reſiſt the edge of ſteele, neyther can they eaſily as other parts How they differ from bones. Why they are hard & how.

of the body be burnt with fire. *Hippocrates* in his booke *de Carnibus* aſcribeth the cauſe of their hardneſſe to the quality of the matter out of which they are ingendered, for hee writeth that out of the bones of the head and the iawes there is an increaſe of a glutinous matter. In that glutinous matter the fatty part falleth downe into the ſockets of the gums where it is dryed and burnt with the heate, and ſo the teeth are made harder then other bones becauſe there is no cold remaining in them.

Their ſurface

Their outward ſurface is by nature white, ſmooth and poliſhed, but in age for want of care or by diſeaſe they become liuid or duskiſh. There groweth alſo vnto them a hard ſcaly matter by which as alſo by corruption they become rugged and vnequall, yet ſayeth the Philoſopher a horſes teeth become whiter as he becomes older.

Forme.

Their forme is before ſomwhat round, behind more plaine; where they are ioyned one to another they are euen, and in their extremities ſomtimes thinne, ſomtimes ſharpe, ſomtimes plaine, but alwayes vnequall.

Difference.

They differ among themſelues in figure, magnitude, and number. Their figure in man differeth according to the difference of their vſe in chewing. In fiſhes they are only acute or ſharpe. In thoſe creatures that chew the cudde they are of a double forme; ſome *Grinders* and ſome *Shearers*. In men according to the three ſpeciall diuiſions of meates there are three kinds of teeth, *Shreaders* or *Shearers* called *Inciſores*, *Dog* teeth called *Canini* and *Grinders* called *Molares*.

Againe mens teeth do not ſtand out of their formes as a Boares tuske, but are concluded or ſhut within the mouth; neyther are they ſet like the teeth of a Saw as it is in dogs, for their teeth are giuen them in ſtead of weapons.

Magnitude.

The teeth of a man are much leſſe then the teeth of many other creatures leſſe then he, for his mouth is much leſſe: for according to the magnitude of the mouth is the ſtrength of the teeth which conſiſteth in their figure, hardneſſe, and quantity; yea mens teeth compared among themſelues are not equall but ſome greater ſome leſſer, for the grinding teeth are greater then the reſt.

Number.

The number of the teeth is not in all men one and the ſame, for ſome haue more, ſome haue fewer, yet the more the better, for ſuch, ſaith *Hippocrates* in the ſixt ſection of the ſecond *Epidemion*, are long liued, whereas thoſe that haue few teeth are but ſhort liued as *Ariſtotle* ſaith in the 3 chapter of his 2 booke *de hiſtoria Animalium*. The reaſon is, becauſe the paucity and rarity of the teeth is an argument eyther of the want of ſpermatical matter or of the weakneſſe of the formatiue faculty.

Againe, thoſe that haue but few teeth do not chew their meate ſo throughly, nor prepare it ſo well for the ſtomacke. So that the Chylus is not ſo well concocted, and by conſequence the bloud not ſo pure; for the ſecond concoction which is in the veynes of the Liuer doth not amend the error of the firſt concoction which is made in the ſtomack.

Diuers rowes of teeth in ſome men.

Stories make mention of ſome men who haue had but one tooth in their vpper iaw, and thereupon haue ſome bin cald μονὼδοντες, as *Euripheus* the *Cyrenian*, *Euriptolimus* of *Cyprus* and *Pirhus* the King of the *Epirots*. Some in ſtead of teeth haue one continuall bone, ſuch was the ſonne of *Pruſias* King of the *Bythinians*. Some haue had a double row of Teeth, as *Dripetinus* the ſonne of King *Mithridates*, *Trimarchus* of *Cyprus*. Some haue had 3 rowes as *Hercules*, for ſo *Cælius Rhodiginus* reporteth in the third chap. of his fourth booke. But for the moſt part there is but one row which is called φραγμὸς, *Septum* the hedge, becauſe it hedgeth in the tongue. In both iawes there are in growne bodies 32 Teeth, 16 in each iaw, in ſome men 30, ſixteene in the vpper iaw and 14 in the neather; in ſome 28, which is the leaſt number, and then the foure laſt are wanting, for they doe not breake out in all men nor at the ſame time, ſomtime lying imperfect within their ſockets, ſometimes not formed at all by Nature.

And truly the grinding Teeth are the cauſe why Authors do not agree in the number of the teeth, for the nũber of theſe *Grinders* is often changed, the *Shearers* & the *Dog*-teeth in man very ſeldome. Theſe Grinders are ſomtimes fiue in a ſide, ſomtimes foure, ſomtimes foure on the left hand and fiue on the right, or on the contrary; or elſe four below and fiue aboue, which variety is made by thoſe Teeth which wee call *Genuini*. The Teeth were made many not one, that they might do ſeuerall offices in cutting, breaking, and chewing the meate; againe, that when one is payned or periſhed eyther by force or by corruption the affection ſhould not become common to them all.

Why many teeth.

A mans Teeth are ſet in both parts of his mouh in the vtter compaſſe of both the iawes;

Fiſhes

Fiſhes haue their Teeth in their Pallate and their tongue: Crabs in their ſtomacke. *Alexander Benedictus* witneſſeth that in a mans pallat ſometimes Teeth haue been ingendered, and *Euſtachius* teſtifieth the ſame thing from his owne experience in a woman of *Rome*. Thoſe creatures that chew the Cud haue their lower gang of Teeth whole, which reacheth euen to their Lippe, ſo diſpoſed and ſo equally ranked, that ſayth *Galen*, *Nature is much to be commended for ſo ordering the dance*, ſo he cals their rank or courſe.

The Teeth therefore are ſtreight, inclining to neither part, before are the *ſhearers*; called *Inciſores*, next to them the Dog-teeth called *Canini*, and then follow the *Grinders* or the *Molares* which are the hindmoſt, yet ſo that they are all diſioyned with a decent and conuenable diſtance, which the Grecians call διαστὰν, for they are ſet cloſe one to another, and touch at the top, leaſt that which is chewed ſhould remaine in the ſpaces betwixt the and there putrifie. Their order.

The rootes of the Teeth doe enter into the holes or ſockets of the iawes, to which they are ſo fitted, that a nayle ſticketh not faſter in a poſt then they do in their proper places; euery tooth being compaſſed with ſlender proceſſes of the iawes which hould them faſt that they fall not out or be ſhaken.

Euery Tooth alſo ſayth *Galen* hath a nerue, and that nerue helps to eſtabliſh it, for when the nerue is looſened with too much moyſture, the Tooth becomes prominent and moouable: beſide they are very ſtrongly tyed by Ligaments which paſſe betwixt their rootes and the bottom of their ſockets. The Gummes alſo doe eſtabliſh the teeth very much, faſtning about them very exactly; and this *Commiſſure* of the Gums and the colligation of the iawes, *Rufus* cals *habena* or the bridle. In a word the Teeth are vnited by the interpoſition of nerues, membranes and fleſh. The nerue is inſerted into the cauity and ſo the Teeth may be ſaid to be ioyned by *Synneuroſis*. The fibres of the membranes do cleaue to the rootes of the Teeth: the fleſh compaſſeth them about, which being eaten away, they eyther grow looſe or fall out, and ſo they are ioyned by *Synſarcoſis*. Their compoſition.

Hence we may gather that the articulation of the teeth is by *Gomphoſis* or by *mortize* which is a kind of coarticulation, and yet *Galen* doubteth hereof and ſaith, that their compoſition commeth neare to a Coalition: neare; it may be, but indeed they are coarticulated, which may be prooued, becauſe when for want of nouriſhment they grow drye and begin to wither, then their connunction is not ſo ſtedfaſt but looſe and vncertaine, which hapneth alſo when the nerue vnder them is ouer moyſt. Finally, their rootes are ſimple, double, treble and fourfould. Is by way of mortize.

CHAP. XIIII. *Of the Shearers and Dog-teeth.*

WE ſayd before that according to the three kinds of diuiſions of Meats, there are alſo in men three kindes of Teeth called *Inciſorij*, *Canini* and *Molares*. *Inciſorij* we cal the *ſhearers* or the *ſhreaders*; [t. 11. fig. 3.[b] 1. 2.] they are ſeated in the forepart of the iawe, and becauſe they are the firſt, they are called by *Hippocrates* and *Ariſtotle* πρόσθιοι, *primores*. 3 kindes of teeth. Both in vſewe and generation.

They are ſharp edged like a knife and broad alſo the better to deuide that that comes betwixt them, and are therefore called τομεῖς. Sometimes they ſheare a thing aſunder as a paire of pinſons doth a wire, and that is when the lower teeth are vrged, not againſt the ends of the vpper, but higher toward their bodies. And becauſe theſe Teeth in laughter diſcouered, therefore the Grecians call them γελάσινοι.

Theſe *Shearers* are for the moſt part foure, and thoſe two that are next the *Dog-teeth* are leſſe then the other, and ſhorter then the *Dog-teeth*. [ta. 11. fig. 3. char. 2.] *Gorreus* ſayth that ſome men in ſtead of theſe foure, either aboue or below haue onely two, but thoſe ſo broade that they take vp the roome and performe the vſe of foure. Some againe in ſtead of foure *ſhearers* haue ſixe, eight, or more placed without any order, ſome of them being right, others crooking outward to the Lip, others inward into the mouth, which are ſo offenſiue both in chewing and in pronunciation, that we are conſtrained ſomtimes to draw them, ſometimes burne them, ſometimes to file them. *Bauhine* maketh mention of a Doctor of Diuinity, whoſe two foreteeth in the lower iaw were double, for when the two vtter were almoſt conſumed about the fortith yeare of his age two other grewe vp within them. The part of theſe Teeth which ſtandeth without the Gummes is narrower betwixt the Baſis and the ſides, but before and behind thicker, growing thinne and broad by degrees vnto the extremity: eſpecially it is ſo in the vpper two which are called *duales* and Are foure.

Palæ, becauſe they are very like vnto a pale: the ſuperficies is on the outſide ſome-what gibbous, and againe a little hollow on the inſide. The other part of theſe teeth which is infixed in the Iaw is toward the ſide flatted or compreſſed and endeth in a ſharp point; for their roote is but ſingle; yet greater for the moſt part, at leaſt as great as any the roots of the great teeth: hence it is, that they eaſily fall out, eſpecially thoſe in the vpper iawe. In the extremities of theſe Teeth when men are growne to ſome age, there is either no perforation at all, or if it be it is wonderous obſcure.

Dog-teeth. Next to theſe are the Dog-teeth called *Canini*, [Tab. 11. fig. 3. char. 3] by *Ariſtotle & Galen* κυνόδοντες, not ſo much for their figure, or becauſe they ſtand out of the gummes as Dogs teeth do, as for their vſe; for in dogs after the ſhreading teeth there are two kindes of ſharpe teeth; Some ſtanding outward, others of a triangular forme. But a mans dog-
2 in each iaw. teeth differeth from them both. They are onely two in each iaw, becauſe a man is a mild and ciuill creature, whoſe ſtrength conſiſteth more in wiſedome then in fortitude of bodye, and therefore is not full of Dog-teeth as other furious and rauening creatures are; for to breake that which is hard two were ſufficient. Theſe go betweene the ſharpe teeth and the plaine, the Shearers and the Grinders, and below at the gummes are broad and thicke, aboue ſharpe and ſomewhat prominent beyond the courſe or order of the reſt of the teeth. From the Shearers heerein they differ, becauſe they are thicker & their head ſomewhat narrower but not ſo ſharpe. They are alſo harder, that if any thing by chance do come betwixt the teeth which the ſhearers cannot diuide, theſe may breake it; for the ſhredders were made to cut meate ſhort, and theſe to breake that which is hard.

Their rootes. Their roots as thoſe of the ſhearers are but ſingle yet infixed deeper, ſtronger alſo and leſſe preſſed or narrowe before then behinde. Theſe rootes are longer then the ſingle roots of the reſt of the teeth, yet ſo that the vpper are ſharper and longer then the lower. Theſe they call the Eye-teeth, not that they are ſo produced that they touch almoſt the lower circumference of the eye, for they do not go aboue the lower end of the wings of
Eye teeth. the noſe, but becauſe a portion of the Nerue which mooueth the eyes is deriued vnto them; and hence it is that it is commonly and truly ſaid, that to draw the eye-teeth is not without danger.

CHAP. XV. *Of the Grinding Teeth.*

The Grinders THE great Teeth the Grecians call μύλαι or μύλοι *Molares*, becauſe by them the meate is broken as corne is broken vppon a Mill. They are ſeated in the inner part of the mouth and hidden by the cheekes: the reaſon of this
The Forme. poſition is, leaſt the meat already ſhred or broken and by the tongue rowled vnto theſe Teeth to be further ground ſhould fall out of the mouth. In their vſe therefore and likewiſe in their forme they are like vnto a Corne-quern, vnequal, rough, hard, broad and great: Rough and vnequall, for ſo they are more fit for comminution, and that is the reaſon why Millers when their ſtones are growne ſmooth do pick them anew. But theſe Teeth in olde men by long attrition do becom equall and ſmooth and by reaſon of their perpetuall vſe, are more ſooner broken and eaten out then the reſt.

Wherefore that part of theſe grinders which ſtandeth without the gum is fourſquare, and that ſquare more perfect in the 3 hinder teeth: and though their tops are very large inſomuch as *Ruffus* in the eight chapter of his firſt Book calleth them τραπέζας *Tables*, yet they are not ſmooth, but euery one, ſaith *Euſtachius*, hath a pit one or two in the midſt: whence it commeth to paſſe that their extreame or outward partes are ſomewhat high. Thoſe two that are next the Dog-teeth are heightned on the inſide and on the out-ſide, yet the firſt eſpecially in the lower iaw doth ſometime want his inwarde eminence: the third protuberateth or ſwelleth vp in foure corners: the fourth and the fifte for the moſt part haue two eminences on the outſide, on the inſide but one. Theſe cauities and protuberations meeting iuſt one with another do hold the meate faſter that it fals not ſo eaſily from betwixt them.

They are the hardeſt, ſaith *Veſalius*, of all the bones, that they might not ſo eaſily weare away; broad alſo and plaine the better to leuigate the meate that is alteady ſhorne and broken by the other teeth; for it was not fit that a man ſhould ſwallow his meat before it were perfectly ground: beſide being ſo ground, the heat & moiſture of the mouth aſſiſting, there is made in the mouth a rude inchoation or beginning of concoction.

They

They are called also γομφίοι, not because their insertion is by way of mortize; for that is common vnto all the Teeth, but ἀπὸ τῆς γομφιάσεως, that is from the rough superficies of a Mill-stone, whose figure and vse the vpper partes of these grinding Teeth doe elegantly imitate. In Magnitude they differ, for the middlemost are the greatest, & those on each side lesser. The third is the greatest of all in Men, in Apes the fourth and the fift; for it was not fit that the internall capacity of the mouth which groweth narrow as the anterior part doth, should haue teeth so great as the middle where it is broadest of all. Sometimes to the fourth or the fift (but in the vpper iaw rather then the lower) there is adioyned as it were a halfe tooth, for Nature contending to make more grinders, is hindred by the narrowness of the place, and therefore is constrained to ioyne them together. Magnitude.

Their Number is commonly in the vpper and lower Iawes on each side fiue, that is in all twenty. The reason why there are more grinders then shearers is, because Nature doth vse according to the largeness or narrowness of the fissure of the mouth to allow creatures more or fewer of this kinde. Man whose mouth is verie narrow, & whose teeth were especially giuen him to chew his meate, hath therefore more grinders then shearers or dogteeth: on the contrary in rauenous creatures there are more *shearers* then *grinders*, because they vse them as weapons. Hence it is, that in men there is little difference in the number of their Shearing or Dog-teeth, but of Grinders there is great variety: sometimes fiue, sometimes foure, sometimes six. *Eustachius* did neuer obserue so few as three, sauing once in a Cardinall. It may be his Iawes were short. And this variety *Gal.* makes mention of, although there be no such variety in Apes; whence saith *Eustachius* (and the obseruation is very good) it may well be concluded, that *Galen* did vse to cut vp not apes onely but men. Number.

The two latter grinders both in site and generation, are called by *Hippocrates* in his Booke *de Carnibus* σωφρονιστῆρες, *the Teeth of wisedome*, because when they growe vp a man beginneth to be wise; for they arise about the fourth Septenary, that is, at 28. yeare old, at what time men are or should be temperat and moderate. In the breeding of these teeth there is sometime great torment and paine, and therefore *Auicen* calleth them the teeth of Sense. They spring vppe sometime in olde age, and therefore *Aristotle* calleth them κραντῆρες, because they perfect the age or growth: the Latins call them *Gemnuos*, to which Teeth this is peculiar, that they do not begin to breake out till all the rest haue beene a good while perfect. Sometime also they onely perforate the gummes but rise little aboue them; sometimes they lurke al together in the iaw, and are couered with the gums, sometime they are not created at all. The teeth of Wisedome.

The roots of these Teeth are perpetually of one forme in Apes, as *Eustachius* elegantly declareth, for in them the grinders of the vpper iaw haue three roots: of the lower iaw two, excepting sometimes the fift; the fourth as it is the greatest, so are the roots thereof greatest. In Men their roots are not alwayes of one forme, yet mostwhat they are many and alike: sometime in the fift of the lower iaw, (in the second also *Eustachius* obserued the same) which because of his magnitude a man woulde thinke should haue many roots, there is but one, thicke and perforated with one broad hole. Other roots of the Teeth haue an equall or vnequall superficies, and within two or three holes skilfullie thrilled and disseuered by thin scales, much like a Hony-combe. In the fift grinder there are three, in most of the rest two. Oftentimes the roots grow together, sometime they are separated, sometime a man cannot perceiue so much as the line that parteth them. Their roots in Apes.

The Figure also of these Rootes is diuers, for some are round, others streight and acute, others obtuse, plaine and crooked. They differ also in magnitude, the roots of one tooth being thicke sometimes, sometimes narrow, of another short, of another long, of some broad and thin, yet for the most part the roots of the vpper teeth are longer and of the lower teeth shorter. Their Figure.

They varry also in situation, some touch one another, some growe neare but touch not; some straddle one from another like the feete of a stoole. Againe, some stande off one from another, but yet are so incurued that their extremities doe touch, others running foure wayes are in their ends most of all disioyned, and these in drawing of Teeth are sometimes broken and put the man to cruell torment. Situation.

If there be three roots, especially in the vpper iaw, one runneth inward and two outward. To conclude, commonly the two vpper grinders which are next to the *Dogteeth* are fastned into their sockets with two roots, the other three with three. Sometimes, the

fift hath foure which is rare. Againe, the two lower Grinders which are next to the Dog teeth haue but one roote, the three others two. Thoſe Teeth which we call *Genuini* or *Teeth of wiſedome*, haue very ſhort rootes, partly becauſe that portion of the iaw wil not admit a deepe inſertion, partly becauſe in the leuigation or chewing of meate they are not in ſo much vſe as the reſt. Wherefore the rootes of the grinding Teeth of the lower iaw are fewer and ſhorter then thoſe of the vpper, becauſe the ſubſtance of the lower iaw is harder and more ſolid, and therefore better able ſtrongly to containe the Teeth, and to beare their waight; but in the vpper iaw which is more rare and ſoft and wherein the Teeth hang, and therefore are more ſubiect to fall out with their owne weight, their rootes are longer the better to faſten them, for they needed more ties as it were to binde them and to containe them within the iaw.

Hence it is that where the rootes are ſhorter the Teeth are drawne with leſſe danger, but with more labour where they are many, eſpecially if the rootes grow vnto the ſockets.

Their perforations. The rootes of all the Teeth are perforated euen into their internall cauities, yet this perforation in perfect and growne Teeth is very ſmall, and that in the ſharpe pointe or top of the roote through which a veyne, an artery and a nerue are admitted; of which Veſſels we will ſpeake in the next place but briefly becauſe we haue touched vppon them before.

CHAP. XVI. *Of the Veſſels and Senſe of the Teeth.*

The veines. THrough the holes of the rootes of the Teeth al manner of Veſſels do run and are diuerſified in their internall cauities; veynes to bring them plentifull nouriſhment. Now it was neceſſary that the Teeth ſhould alwayes grow, becauſe in mutuall attrition they were one againſt another, & this we may certainly conclude by our owne experience. For if a tooth fal out or be drawne, that which groweth oppoſite againſt it will be longer then the reſt of the Teeth of his owne ranke, becauſe it is no more worne by the Tooth that before was oppoſite againſt it, the reſt of the Teeth by their mutuall attrition in chewing of the meat are impaired and againe ſo much increaſed.

Arteries. Arteries alſo do enter into the Teeth to preſerue and keepe their naturall heat; hence it is that in inflamations there is a beating or pulſing payne felt, ſuch as fleſhy parts feele when they are inflamed. And this *Galen* firſt of all men obſerued in the 8 chap. of his fift book *de Compoſitione medicamentorum ſecundum loca*, for he found in himſelf not only paine but a pulſing paine in his Teeth, whence he concluded that there was one paine in the Gums, another in the very ſubſtance of the Tooth. Yea without any inflamation of the Gums ſomtimes there is paine in the proper body of the Teeth, ſomtimes in the nerue.

And againe vnleſſe vnder the Tooth there were an artery, how could ſo much florid and pure bloud iſſue when the Tooth is perforated, which *Euſtachius* obſerued in a man that fell into ſuch a flux of blood that he had like to haue died vpon it.

Nerues. They haue alſo nerues ſoft and ſlender, which come from the third coniugation commonly ſo called, and runne through their rootes into their cauity, euen from their firſt conformation; where they are diſſeminated and their ſmall ſurcles are mixed with the mucous matter of the Teeth; hence it is that when that mucous matter is become bony yet it eaſily conſenteth with the nerues and the Teeth become ſenſible; whereas to other bones there are no nerues at al conuayed which may be diſperſed into their cauities. And therefore it is truely ſaide that bones want nerues although the membrane which is called *Perioſtium* haue ſenſe and nerues in it. Wherefore when this *Perioſtium* which is of exquiſite ſenſe is affected, the paine may be thought to be in the bones themſelues when it is onely in the membrane; ſo in a Cicatrice which hath no ſenſe wee imagine wee feele paine when indeed the paine is onely in the neighbour parts; and the membrane which *How Teeth haue ſenſe.* inueſteth the Liuer being affected we thinke we feele paine in the Liuer whereas the *Parenchyma* or ſubſtance of the Liuer it ſelfe is inſenſible: vnleſſe any man will ſay that the bones haue ſenſe by the helpe of the Senſatiue ſoule by which they ſubſiſt: and yet that very obſcure, becauſe the hardneſſe of the bones doth very much reſiſt any ſuch ſenſation; and thus we may ſay that bones do differ from plants as being particles of a ſenſatiue creature.

Theſe

Theſe nerues of the Teeth are very ſmall, yet in our Table we haue made thē large imitating therein *Veſalius* and others. But by what order and manner of diſſection, we vſe to make demonſtration of the veſſels and nerues of the Teeth, ſaith *Bauhine*, wee will now relate as we learned it out of *Euſtachius*.

How to demonſtrate the veſſels of the Teeth. *Euſtachius*.

Theſe veſſels are better demonſtrated in the iaw of a great creature, as for example, in an Oxe, then they are in a Man: and againe the adminiſtration is eaſier in the lower iaw then in the vpper. We take therefore the lower iaw of an Oxe and open it on the inſide, & preſently we meet a cauity full of marrow, together with the nerue inuolued in a membrane; when we haue remoued the marrow & ſlit the membrane throughout his length, then may wee perceiue the nerue made as it were of many ſtrings, betwixt which do run propagations of veines and arteries. Moreouer, if you remooue this membrane with the ſurcles of the nerues and veſſels a little vpward from the bone carefully that you break them not, you ſhall perceiue ſome fibres diſtributed from the membrane not vnlike the Lawny threds of a cob-web. In like manner in the iaw of a Ramme certaine fibres do penetrate the bony partition which is betwixt the Nerue and the Teeth, but theſe fibres are moſt conſpicuous at the roots of the grinders.

From theſe *Grinders* vnto the *Dog-teeth* and the *Shearers* there is a nerue conuayed accompanied with an arterie: the nerue is deuided into two; one part of it, through a hole in that place, breaketh vp at the lower Lip, and a branch of it runneth along vnto the *Shearers*, and affoordeth a ſmall ſurcle to euery one of them; another portion of it is ioyned with the vtter part of the roots: the ſecond part which is alſo the ſlendereſt pearceth into the cauity of the teeth, and may euen without any greater difficulty be diſcerned euen in men.

And truely it is a ſtrange thing that the *Shearers* and *Dog-teeth* which are the leſſe and haue but one roote, haue notwithſtanding allowed them great and conſpicuous ſurcles of veſſelles attayning to their inſertion by a broade and open way; whereas the Grinders which are the greater and haue three, ſometimes foure rootes, are allowed but ſmall and capillary ſurcles made of the former, doubly, trebly and foure-fold deuided, and creeping obſcurely into their inſertion.

Againe, if a *Grinder* or a *Shearer* bee gently and by degrees drawne out of his ſocket, you ſhall finde to ariſe with it out of the cauity of the Iaw very ſmall fibres which are ioyned to the roots of the Teeth: you may alſo obſerue that the parts of the bony partition are full of a mucous ſubſtance which is not vnlike to that whereof the teeth and their huls or huskes are generated

Againe, when the Tooth is drawne, in the extremity of his roots you ſhall find a matter partly mucous partly fibrous, which carrieth a reſemblance or ſhew of a nerue, a veine and an artery.

But if you deuide the Tooth in the middeſt you ſhall finde a mucous ſubſtance wouen with veſſelles and ſome fibres: but theſe things may be better ſeen in the iaw of an Oxe or of a Ram then of a Man; and yet euen in a man diligent ſearch will find them out, though they be not ſo perſpicuous.

Wherefore who can deny but that there is a Pulſatiue or beating payne euen in the inner part of the tooth, as *Galen* and *Euſtachius* haue witneſſed, when he ſhall perceiue an arterie and a nerue attaine thereinto? For veines, why ſhould we not likewiſe beleeue that they enter into the Teeth, when wee ſee it ſprinkled with bloud in men? and in Oxen may manifeſtly perceiue the veſſell it ſelfe? for it is in the tooth as it is in that coate of the eye called *adnata*, as long as a mans Eie is well diſpoſed the veines therein are not viſible, but then onely become conſpicuous when it is inflamed.

Of the ſenſe of the teeth Diuers opinions of Anatomiſts.

Concerning the Senſe of the Teeth, the opinions of Anatomiſtes and Phyſitians are very diuers. Some thinke they haue no ſenſe at all, becauſe they are bones and may be filed without paine; others thinke they haue Senſe, but that of themſelues without nerues, as other bones haue: and theſe men imagine that the paine of the tooth is without it, that is, in the membrane which compaſſeth the ſocket: others thinke they liue and haue Senſe by their inbred heate. *Ariſtotle* determines that they feele cold ſooner then heate, and are more affected by it: *Galen* ſaith they are pained, they beate and receiue ſoft nerues. But the queſtion may be asked what part of the tooth hath this Senſation? *Varolius* anſwereth the body of the tooth, but on the inſide onely. Others ſay that the whole Tooth indeede hath Senſe, but the whole Tooth doeth not feele paine; it perceiueth the firſt and ſecond

qualities

qualities, but the first qualities onely doe paine it, because they exercise their power vpon the rootes of the teeth, into which certaine small nerues doe penetrate. This was *Archangelus* his conceit, and *Laurentius* hath almost the same. The whole Tooth sayeth hee doth *feele*, but more exquisitly on the inside more dully on the out.

Another question may be asked whence comes the sensation that payneth them? some answere, that it is by reason of the nerues and of their proper substance, so saith *Actuarius*. *Falopius* thinkes the paine comes by reason of a thin membrane compassing about the inner cauity. Others ascribe the cause to the nerue and the membrane ioyntly: others to the nerue which cleaueth to the neighbour partes and to the rootes of the Teeth onely. Others to the nerue that entreth the Tooth and a membrane that cleaueth to the roote thereof as it were a *Periostium*. Others to a nerue which penetrateth the substance.

These and such like are the diuers opinions of Anatomists concerning the sense of the Teeth. *Bauhine* interposeth his opinion on this manner.

Bauhines resolution. The teeth, saith he, do feele, and the faculty of sensation is communicated to their substance by the mediation of a very thinne membrane which compasseth the inward cauity of the Tooth lightly hanging vnto it, and also of a soft nerue which attaineth into the same cauity: thus the Teeth haue a proper kind of Touching which we cannot in words so well expresse as by instance. For vpon the eating of sowre or sharpe meates the Teeth are affected with a kinde of stupor, and then we commonly say our Teeth are set on edge, which kind of sensation is proper only to the Teeth and the Gums, and is nothing else but a Symptome of the touching faculty.

But we must conceiue that each part of the Tooth is not equally sensible, but that the inside which is nearest to the nerue and the membrane is of quicker apprehension then the outside, for the outside partly because of the spisse and hard substance which like a shell couereth the inward part of the Tooth, and doth not admit the power of the nerue or the impression of the animall spirit: partly because it is continually accustomed to the mutations that come from the ambient ayer is not so sensible. Euen so we see that the callous skinne in the hands and feete of a labouring man is almost altogether without sense, thogh the skinne it selfe naturally disposed be very sensible.

Wherefore that part which is without the Gummes or the shell of the Tooth is not offended by hard and rough things, for though it be cutte or filed, or burnt with hot yron, yet it is not payned neyther is there any sense or signe of sense following therevppon, especially the height or top of the tooth which was made solid to breake the meate, & therfore the cauity not attaining so far the nerue also commeth short of it.

The reason why a part of the body of the tooth is not payned by fire or by hot iron, *Aritæus* sayth is knowne onely to the Gods. As for vs we can say nothing but that it is a peculiar to the teeth that they are not equally affected eyther by all things that make alteration in them, or by those things which might offend them; but are more affected by heat and cold then by any other qualities, & by cold more then by heate, yet to giue some satisfaction, we say that the teeth are not offended by moist or dry by soft or hard thinges because their qualities are not so suddenly communicated to the membrane or to the nerue. But they are affected by hot and cold things because the animall spirits which are contained in the substance of the tooth and diffused through the same, are thereby altered; for those actiue qualities do pierce on euery side, affecting and changing together with their substance the animall spirite and by succession also the membrane and the nerues.

Great store of animall spirits in the Teeth. And truly it is very reasonable to imagine that in the substance of the teeth there are great store of animal spirits more thē in other bones, first because they receiue soft nerues into their cauities, and againe because theirnternall substance is somwhat rare, made of a mucous matter condensated or thicknesse.

Obserue also that the paine which is felt in the substance of the tooth differeth much from that paine which is in the Gummes, eyther from their distemper or from any flux of humor into them, and from the payne which is felt in the nerue that runneth vnder the roote of the Tooth.

The vse of their sense. The vse of their sensation is thought to be, first that being exposed to outward iniuries, and hauing no *Periostium* to compasse them about; it was fitte they shoulde haue an ingenite principle of Sense that they might bee able to discerne betwixt that which is profitable and hurtfull.

Againe,

Againe if we wil beleeue *Galen* in the second Chapter of his 16. book *de vsu partium*, as all the other parts of the mouth, so likewise the teeth doe after a sort discerne of sapors or Tastes, and for that purpose they receiued soft nerues. For as the Skinne hath Sense, yet through the cuticle or scarffe-skinne which is not sensible; so the marrow of the tooth is apprehensiue of tactile qualities through the bony part, like as the nerueous membrane which is vnder the nailes doth feele heat and cold through the nailes which haue no sense at all. And so much shall haue beene sufficient to haue spoken of the Sense of the Teeth. Now we come vnto their cauities.

CHAP. XVII. *Of the inward cauity and Membrane of the Teeth.*

WEe saide before that the Vessels and the Nerues did enter into the cauities of the Teeth, and therefore it would be very fitte we should acquaint you what this cauity is.

All the Teeth are hollow on the inside, [table 11. fig. 3.] but this cauity is greater or lesser according to the magnitude or figure of the Teeth, which thing also *Aristotle* acknowledged in the 7. chapter of his 3. booke *de historia animalium*, where hee sayeth that the teeth are bones partly concauous and partly solid. Notwithstanding some new Anatomists haue been so impudent as to challenge to themselues the inuention or finding out this cauity. *Galen* indeede in those bookes of his which are extant, doth not write how great or what a kind of cauity this is, nor yet what is contayned therein; yet because oftimes he makes mention of the *Dennes* of the Teeth, it is not likely that he was ignorant of them; for if hee had beleeued that the teeth in their first originall had had no cauities, it had bin an idle thing for him in vehement payne of the Teeth to commaund that their solid substance should be perforated with a small wimble or piercer, in the ninth chapter of his 5. booke *de compositione medicamentorum secundum loca*. Againe, *Hippocrates* in the 4. *Epidemion* reporteth that a Childes Teeth were eaten with a corroding vlcer, those especially that had cauities or were hollow, whereby *Hippocrates* doth insinuate, first that the substance of the Teeth may bee corroded, and secondly that they haue a naturall cauity in them.

The cauity of the teeth.

This cauity is in children of seauen yeares old and somewhat vpward very large, and circumscribed with a thinne scale very like vnto a hony-combe. It is also full of a white humor, not of marrow, such as we may see in the sweet-tooth of a Calfe when it is brought sodden vnto the Table, but this humour in processe of time is dried, becomes harder, and for the most part turnes bony, and so the cauity is euery day diminished; yet so that in the middest at the roote there remayneth alwaies a *Sinus* which scarcely reacheth aboue the height of the Gummes: for it was necessary there should be an empty space left, because of the insertion of the vessels and the dilatation of the artery: yet some men affirme that the pulsation we feele in our teeth doth not proceede from the beating of the artery, but from a spirit or ayre moued, as sometimes we finde it to be in our eares.

The humour therein.

These things sayth *Eustachius* are best perceiued in the *Grinding* teeth of an Oxe broken; and in a Calfe and a Lambe each *grinder* hath three cauities, one *anterior*, another *posterior* & the third in the middest; and the middlemost cauity is perforated with a crooked hole like the letter C which reacheth as farre as to the top of the Gummes: in the two other cauities there is a mucous matter contayned, which for the most part as the Tooth growes perfect turneth bony. Beside, because in these creatures we finde oftentimes two, sometimes three, sometimes foure grinding Teeth ioyned together, Nature to make a mutual consent between them, hath perforated the bony partition with a transuerse hole, through which a matter like a small membrane passeth out of one cauity into another, as surcles of vessels do passe through their perforations.

3 cauities in a calues tooth

This cauity is compassed with a membranous substance, which *Falopius* and *Laurentius* call a thinne membrane. *Goreus* saith it is a production of the *Pia mater*. *Columbus* esteemeth it to bee made of a complication of veines, arteries and nerues, which imbibeth or sucketh vp the matter that falleth vpon it, from whence come the greatest and most intolerable paynes of the tooth-ach.

And indeed this membrane is of most exact Sense, and by it the Teeth are so apprehensiue of heate and cold: yea sayeth *Bauhine* wee consent with *Columbus* herein that the

fluxe

flux of humor out of the Brain vnto this membrane is the true cause of the greatest pains in the teeth which do so long endure as the humour is detained in the Membrane, or till the braine be purged, and so the cause of the flux be taken away.

How the teeth rottes.

By reason of this cauity if the teeth be perforated by an affluence of sharpe humors, which perforation dooth reach to the cauity, then are the teeth quickly rotted euen vnto the roots, againe in this cauity, especially the erotion and putrifaction of the teeth doth begin. In it groweth that dolourous rottennesse, and in it somtimes are wormes gathered which do miserably excrutiate and punish the patient.

The vse of their cauities.

The vse of the cauity is, that by it the teeth may be better nourished, and receiue the faculty of sensation.

CHAP. XVIII. *Of the generation and vse of the Teeth.*

COncerning the generation of the Teeth, there are diuers opinions; some thinke they are generated within the Wombe, as *Columbus* and *Eustachius*; some without the wombe, as *Aristotle*; some partly within and partly without, as *Hippocrates* who maketh a threefolde time of their generation, in his Booke *de Carnibus*, of a threefolde Aliment which ministreth matter vnto them. The first is from the sustenance they receiue in the womb; the second is after birth by the Milke which the child sucketh; the third is after he hath cast his teeth by the meat and drinke that he eateth, whereby new teeth are engendred: for, saith he, whatsoeuer is glutinous in the Aliment that maketh the Teeth, but the fatty part, which heere is more plentifull then in the matter of the rest of the bones, is exiccated by the power of the heate. So also, saith *Laurentius*, as this threefold kinde of Aliment differs in thicknesse, so doth the solidity, hardnesse and thicknesse of the teeth varye, for those teeth that are engendred of the Aliment which the infant vseth in the wombe, or when hee sucks his mothers brest are but soft and do easily fall away, but those that are made of more solide meats are also firmer.

Diuers opinions concerning the generation of the teeth.

The truth.

The truth is that they are generated in the womb together with the rest of the bones, with which they are not delineated but formed and absolued by degrees: wherefore they lye for some time imperfect in the Iawes, neyther do they all breake their prisons at the same time, but some sooner, some later, according as the necessity of Nature dooth require. And this is the cause why some made a double time of their generation, one in the wombe, another out of the wombe.

In the wombe after the generation of the Iawes there are twelue Teeth formed, foure of which are *Shearers*, two *dog-teeth* and six *Grinders*, all which do want roots and lie hid in their sockets, on euery side compassed therwith, and the gummes whole aboue them. And this may be seene in the iaw of an abortiue infant or other creature, yea if it dye presently after the birth; for if you cut vp the Iaw you shall finde Teeth therein. Some haue bene borne with their Teeth out of their gummes, as of olde time *M. Curtius Dentatus*, and *Cn. Papyrius Carbo*. Of later times, the same is reported of *Richard* Crooke-backe the Vsurper.

The substance of the Teeth being yet imperfect is partly mucous and partly bony, for if you take away the husk of the Tooth, (for there is about euery Tooth such a white, mucous and slimy substance somewhat membranous wherewith the tooth is couered, which also is so much the more mucous by how much the tooth is the softer and the younger) perforating it in the vpper part, that the end of the Tooth may peepe out, then shall you perceiue that the tooth is partly bony, partly mucous; for that part which was to rise aboue the gummes is fashioned into a white scale, thin and excauated or hollowed like a Hony-combe, and so the vpper part of the Tooth is bony, hard and hollow. The other part which should haue remained infixed in the Iaw, is soft, moyst and mucous, like the substance that is in a young quill.

The substance of the Teeth diuers.

Their hard part.

The soft part.

This substance seemeth to haue fibres and threds and to be couered as it were with a thin coate, for the superficies thereof is like to a smooth tunicle fastned and conioyned to the substaunce that it containeth: wherefore a resemblance of the generation of the teeth wee haue some what expressely in the generation of a quill: for the part which is without the skin is horny and hard, but that which is within the wing is softer and moyster, yea sometimes like blood or congealed Phlegme. This soft part of the teeth as they breake the flesh hardneth by degrees, and by degrees becommeth bony. Sometime also it is hollowed within and formed into roots.

The

The hull or huske of the Tooth whereof we ſpake euen now ſerueth inſteade of a Ligament, for by it the tooth is faſtned as with glew to the ſocket and to the gums.

In Infancy the Teeth be within the Gummes that they might not byte the Nurſes nipple: the ſeauenth moneth they beginne to breake out, or later ſayth *Hippocrates*, if the Infant do toothe with a Cough, and then they are troubled with Agues, Convulſions, Scowrings and ſuch like, eſpecially when they breede their *Dog-teeth*. *Galen* rendereth a reaſon, becauſe when the Gummes are perforated by the Teeth the paine is as violent as if a goade were thruſt into the fleſh, but indeed the teeth are more paynfull then goades, for if a goade be once faſtned it reſteth, but the tooth iſſueth ſtill to the extent of his augmentation.

The Teeth breake out not altogether but the vpper ſooner then the lower, and the Shearers ſooner then the Grinders: that they iſſue later in men then in bruite beaſtes (for the Elephant ſaith *Ariſtotle* in the 5. chap. of his 2. book *de hiſt. animal.* breedeth his teeth as ſoon as hee himſelfe is borne) the reaſon is ſaith *Ariſtotle* becauſe a man aboue all creatures hath leſſe of that earthy excrement whereof they are ingendred. But becauſe the firſt Teeth and thoſe that follow them which are thought to bee regenerated, do lie hidden in the iaw-bone, therefore wee rather ſay that the cauſe of their late yſſuing in men is to bee attributed to the good will and pleaſure of him that made them, who moderateth all things according to his owne wiſedome; yet when the childe comes to chewing, that he might ceaſe to be troubleſome to his mother, and not lie alwaies lugging at her breſts but fall to ſtronger kinds of meate, therefore at length Nature put them foorth; for euery particle is then accompliſhed when Nature ſtandeth in neede thereof, and this is the reaſon why the Teeth are not formed till after the birth. For this cauſe alſo ſayeth *Ariſtotle* the Shearers doe yſſue before the Grinders, becauſe the meate is firſt ſhred before it bee ground.

The times of dentition

The firſt

Dentition or the breeding of the Teeth begins about the ſeauenth yeare, ſometimes ſooner, but then ſaith *Hippocrates* in his booke *de carnibus*, they are ingendred of an ill humour. The firſt Teeth that ariſe are the fore-teeth; *Democritus* ſaith becauſe their ſharp ends make way before their due time. *Ariſtotle* reprehends him and giueth another reaſon, becauſe that which is ſharpe doth ſooneſt grow blunt: & therefore Nature ſendeth a ſupply of others; the broade Teeth are not blunted at all but onely leuigated by attrition, and this is *Ariſtotle* his conceite in the 8. chapter of his fift booke *de generatione animalium*.

When the firſt Teeth about the ſeauenth yeare are either drawne or thruſt out by thoſe that come vnder them, then doe thoſe firſt Teeth appeare ſoft and as it were hollowed: and therefore ſome haue thought them onely Appendances of certaine rootes left in the iaw, of which roots, as it were of ſeede, a new hope or ſucceſſion of teeth is broght forth. *Veſalius* therefore counſels vs to take heed that when a childes tooth is broken by accident we doe not draw the roote, for then haply the tooth will not grow againe. But Anatomy teacheth vs the contrary, that is to ſay, that there is no coniunction betwixt the imperfect teeth that fall at ſeauen yeares of age and the perfect that ariſe after. Nay they do not ſo much as touch one another, for there is a partition in the midſt betwixt them before the new tooth can breake forth. And thus much of the firſt time of the generation of the teeth within the wombe.

The ſecond time of their generation is without the womb, about the ſeuenth yeare, and theſe teeth are commonly thought to be Regenerated; but to ſay trueth and to ſpeak properly, they are then neither generated nor regenerated. For together with the firſt Teeth in the beginning of generation they doe receiue with the reſt a rude kinde of forme, and are made of the ſame matter; otherwiſe wee muſt be conſtrayned to confeſſe, (and that were very abſurd) that Nerues, Veſſels, Ligaments and Membranes which are ſpermaticall partes and doe conſummate the frame of the Teeth, doe beginne their generation after the Infant is borne ſeuen yeares, more or leſſe. It is true indeed that theſe latter Teeth are not ſooner abſolued or perfected then in the ſeuenth yeare or there abouts, and the proportion ſeemeth not to bee much amiſſe, for they firſt break out of the Gums about the ſeauenth month, and the ſecond about the ſeauenth yeare. And this proportion *Hippocrates* in his booke *de ſeptimeſtri partu* ſtandeth much vpon, not only in the production of the Teeth, but alſo in other mutations in the body of man.

The 2. time.

Falopius conceiueth that the latter Teeth are made of the ſame matter with the former.

mer by the seminary faculty which remaineth in the iawes, and *Eustachius* confesseth that if you remoue the bony partition that is betwixt the first and the later teeth you shall finde the seedes of the Teeth one vnder another, I meane of the Shearers and the Dog-teeth, but of the Grinders he neuer found any seedes, and yet he thinketh it reasonable that they should haue a rude originall in the wombe which is accomplished afterward at leasure.

The number of the teeth. How they issue.

The teeth which about the seauenth yeare break out, or as some say are renewed, are in eyther iaw ten, foure Shearers, two Dog-teeth, and foure Grinders or Maxillaries that is two next vnto the Dog-teeth, and two that are called *Genuini* or *Teeth of wisedome*. The shearing teeth when they breake forth do thrust the first shearers out before them and issue betwixt the two first, the second, and the Dog-tooth that is next vnto them. But if the former teeth will not fall or be not pulled out, or if the latter issue before the first fal, then the latter worke their way through new sockets and turne in the vpper iaw outward, in the lower iaw inward, so that there seemeth to arise a new row of teeth, and this indeed hath deceiued many Hystorians and some Anatomists also.

The Dog-teeth also do fall out and the place of the succeeder is a little of the one side the roote of the former.

The reason why the teeth about the fourth fift sixt or seauenth yeares do grow loose, is because the sockets do continually increase and the teeth are but soft and therefore doe soone perish, because the harder Aliment which from thenceforth accreweth vnto them is nothing conuenable to their substance and then they putrifie and fall away: but those teeth that breake out at the seauenth yeare receiue nourishment agreeable to their substance, and therefore do continue as long as their nourishment is supplyed. Among the grinders the two first do somtimes thrust out their predecessors, but for the most part they arise at their sides and increase the number; those two that are called *Genuini* doe neuer thrust out them that were before them, but yssue somtimes in extreame old age, in the very ends of the iawes; yea *Aristotle* reporteth that these teeth haue arisen not without great paine after fourescore yeares. Notwithstanding this is more rare in men then in women. *Hippocrates* in his booke *de Carnibus* witnesseth that these teeth which grow vp so late doe wax old together vnlesse by mischance they fall out or perish.

The manner of their generation.

The manner of the generation of the teeth *Fallopius* thus expresseth. The quickening faculty by an actiue spirit makes the bone hollowe; at the same time is ingendered a membranous huske which hath two ends, one posterior whereat a small nerue, a veyne & an artery do meete. The other anterior whereat hangeth a neruous tayle like growne Malt: and this taile creepeth through a narrow perforation of the bone to the side of that tooth which hath a successor and so passeth vnto the Gums.

In the foresaide husk there gathereth together a white and slimy matter, and the first part of the tooth becomes bony when as yet the latter part is soft, euen so as we saide it was in the teeth formed in the mothers wombe.

Euery tooth yssueth through that hole dilated, through which the tayle or beard of the huske was transmitted. Instantly the huske is broken and becommeth as we said before a ligament to the tooth, and the tooth it selfe issueth naked and hard, notwithstanding the hardest part of it receiues a further perfection by induration of his matter without the Gums.

Their vses.

The primary and first vse of the teeth was to diuide to breake, to chew or mitigate the meate and so to prepare it for the stomacke. Againe, another vse of the teeth is for the forming of the voyce, for Shearing teeth are of great consequence to true pronunciation of letters or words; and hence it is that those that want their teeth cannot so well pronounce R, S, X, Z, yea it is thought that the shearing teeth in men haue no other vse but only for elocution although the Infant doth not lightly speake before he haue all his teeth, or at least some of all kindes. VVhen he hath a few teeth he will mumble and as it were record, but cannot articulate plainely till he haue all, yet these shearers do not equally assist vs in the pronunciation of all words, only they make the prolation of some more cleare and facile. Those words that are formed of T and R cannot bee pronounced without the shearing Teeth articulatly, for they require that the Tongue should rest vpon the fore Teeth. *Laurentius* saith the Teeth were made for ornament, but *Homer* more wisely, that they were giuen to men to keepe their Tongues within compasse. *Bauhine* thinkes that the Teeth of themselues are not onely no ornament but a fearefull sight, and therefore Nature compassed and distinguished them with Gums, couered them with

the

the lip as it were with a buckler the better to break & change the ingresse of the outward aer. Those creatures who are able eyther with their hornes to defend themselues as a Bull and Cow, or with their hoofes to offend their aduersaries, those creatures I say haue teeth onely to eate withall. They that haue saw-teeth do both mitigate their meat by them and stand vpon their guard with them, for they are giuen to such creatures both to offend and to defend, whereas a man hath his hands to defend himselfe.

And thus much shall be sufficient to haue saide of the Teeth, their Sockets, their Nature, Figure, Magnitude, Number, Site, Articulation, Kindes, Vessels, Sense, Cauitie; and finally of their Generation and Vse.

And thus we haue brought to an end the history of the bones of the Scull and of the Face. Another bone there is which belongeth not indeed to the head, but much lesse vnto the Trunk or the ioynts, whose history we will therefore insert in this place because it is neare vnto the Head though it be not of it, and that is the bone *Hyois*.

CHAP. XIX. *Of the bone Hyois, called Os gutturis.*

THAT bone which from the similitude it hath with the letter υ is called *Hypsiloides*, or shorter *Hyoides*, [Tab. 11, fig. 4, and 5,] is seated in the chops before the top of the Larinx, and therefore is also called by *Galen Os gutturis*. It lyeth like a foundation vnder the basis of the tongue, and is extended directly along the necke, and the figure of it is farre other in men then it is in brute beasts. It representeth the letter υ, for the termination thereof is not in an acute angle but in a bow or bent, and therefore is not much vnlike the lower iawe, for it is not onely curued like a bow as that is, but also determineth into two processes. The figure of it was thus made that the way might be left open for the meate to passe into the stomacke and for the breath to passe and repasse to and from the Lungs; for as wee sayde euen now, it is placed iust before the chops and the Larinx.

The bõe *Hyois* His situation.

Figure.

Although this bone be expressed by one single name yet is it not one bone but compounded of many, at least of three, at most of thirteene, but for the most part in antient men it consisteth of eleuen bones which are ioyned together by a laxe or dissolute composition with a gristle betweene them that they might better yeeld and giue place when they are mooued.

The parts.

The ends of this bone do not touch the ends of any other, and therefore it is fastened to the neighbour parts, otherwise the tongue could not haue rested vppon it as vpon her basis. The continuity therefore that the bone *Hyois* hath, is by the mediation of muscles and ligaments, for it is continued to the lower iaw about the Chin, to the brest-bone, to the shoulder-blades, to the Appendix of the Nowle called the Bodkin; to all these I say, by that kind of Coalition which we called *Synsarcosis*, for it is bound by flesh or *Flesh bounde*. Of all the bones, that is the first which is in the middest, greater and broader then the rest, and as it were their basis. [Ta. 11, fig. 4, A B C D] On the anterior and exterior part that regardeth the mouth, it is conuex and determineth into an obtuse or dul angle, which we may feele in our selues aboue the Throttle although the processes do lye very deepe. This angle was made partly to secure it from outward iniuries, partly to affoord an implantation to some muscles. On the inner or posterior side which reguardeth the chops it is hollowe, [Ta. 11, fig. 4, D · fig. S P ·] from which hollownes two muscles of the Tongue do arise, and beside the cauity giues way to the Epiglottis to open and lift it selfe vp.

It hath three bosomes; aboue, a transuerse depressed bosome [C] to admit the second paire of muscles which are proper vnto it, in the midst it buncheth out. [*] In the sides of this *Sinus* there are two other cauities, one on the right hand another on the left, which giue way vnto the first paire of muscles that are implanted into the sides of this bone.

Cauities.

It hath also two processes on either hand arising out of the basis, [E F I K] which some cal *Hornes* or *Ribs*, by which it is ioyned to the two lower neighbour bones.

Processes.

The two lower which make the second and third bone [E F] do consist on either hand of one bone; they are shorter and broader then the vpper, and are fastened to the bottome of the sides of the first or middle bone [Tab. 11, fig. 4, G] by the interposition of a gristle & a good broade gristly ligament. At their extremities [H H] because they are not ioyned with any other bone, they couple thẽselues with the processes of the shield-gristle of the throttle, & these processes together with the middle bone make the shape of the letter υ.

The 2 lower.

But because this bone hangs like a meteor, it would not haue had sufficient strength if it had bin only ioynd with the gristle of the *Larinx*; Nature therfore aded 2 other processes

The 2 vpper.

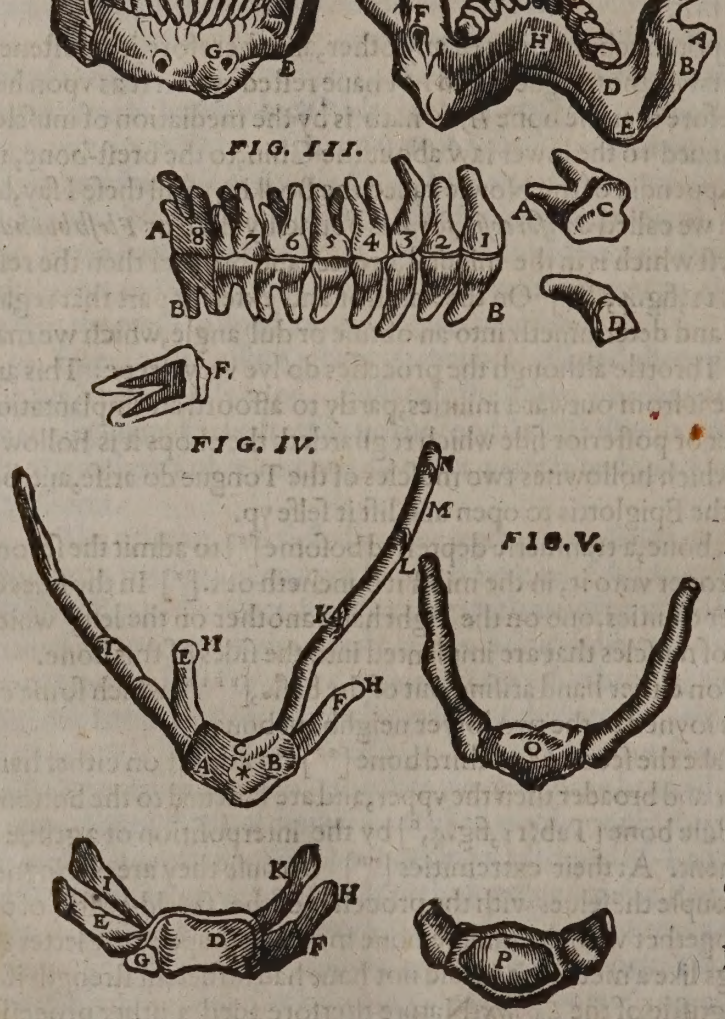
it and firme it to the Appendix called *Styloides*, which is faſtened to the Temple-bone, and by this meanes being ſo on each ſide bound, the bone *Hyois* ſtandeth ſtedfaſt in the middeſt. Wherefore the two vpper proceſſes which make the fourth and the fift bones [I K] and are ſlender, round and long, are faſtned to the vpper part of the ſide of the firſt or middle bone. To theſe proceſſes are oftentimes added on either ſide 3 ſmall Bones, which make the ſixt, ſeauenth, eighth, ninth, tenth and eleuenth bones. They are faſtened with round and ſlender Ligaments to the extremities of the appendix *Styloeides*; ſo that as the two lower proceſſes or the ſecond & third bones together with the firſt make a reſemblance of the letter *v*, ſo alſo the two vpper proceſſes or the fourth and the fifte bones, and thoſe that are aſsiſtant vnto them together with the firſt bone, do again make another *v*, ſo that this bone may well be called *Hypſiloeides*, becauſe there reſulteth a double *vpſelon* out of his figure.

Sometime the vpper proceſſe on either ſide conſiſteth of one ſhort and ſlender bone, and is faſtned to the Appendix *Styloeides* by a neruous Ligament. Sometime it hath only the inferior proceſſes and the vpper bones as the fourth and the fift, and all the reſt to the eleuenth eſpecially in women are wanting, as we haue expreſſed it in the fift figure of the eleuenth Table, and then their place is ſupplyed by long, round, ſtrong and neruous Ligaments, which yſſuing from the firſt or middle bone do paſſe vnto the proceſſes *Styloeides* on either ſide, and then there are onely three bones. Afterward as a man growes in yeares, thoſe which were at firſt but additaments do grow dry and harde, and ſo the Number of the bones is increaſed, till they come to ſeuen, then to nine, after to eleauen, and ſometime though rarely to thirteene.

Sometimes wanting.

How it is eſtabliſhed

Finally, leaſt the bone *Hyois*, ſaith *Galen* in the eleuenth chap. of his 7 book *de vſu par.* ſhould be diſplaced from the middle Region of the Larynx, and leane too much to one



TABVLA. XI. *Fig.* 4 *ſheweth the Bone* Hyois, *as well the fore-ſide as the backeſide with his Proceſſes.*

A, B, C. The forepart of the greater bone.
* His protuberation.
D The backſide of the ſame greater bone.
E, F. His lower proceſſes on each ſide.
G. The connexion of the lower ſide, with a ſmall bone of the broade Bone of the Hyois.
HH. The tops of the Hyois, by which they are ioined to the Larynx.
I, K. The vpper proceſſes.
L, M, N. Three bones of theſe proceſſes.

Fig. 5. *ſheweth the bone Hyois vvithout proceſſes or horns ſuch as Bauhine found in a man.*

O. Sheweth his Anteriour part.
P. His Poſterior.

ſide,

ſide, Nature hath prouided muſcles which ballance it and keepe it equall, and not only ſo, but alſo certaine ſtrong Ligaments in the two ſides of the bone *Hyois*, yea and others that are griſtly and round which ſhe hath inſerted on each ſide; and as if all this were not ſufficient, it is faſtned by certaine membranes not onely to the *Larynx* and *Epiglottis*, but to make it more ſtable, to the Gullet alſo.

The vſes of the bone *Hyois* are very great though it be but a little bone, and very many. It was framed therefore for the tongue and the *Larynx*: firſt to bee a *Baſis* for the tongue aboue which it might be moued diuerſly and ſuddenly, like an Eele ſayth *Laurentius*. The ſecond vſe of it is to lift vp the *Larynx*. A third, that from it many muſcles might take their originall, that is to ſay, ſome of the tongue or the fourth payre. The fourth payre from the firſt of the middle bone, the fift payre from the fourth and fift bone when they are there, when the fourth and fift are wanting then it ariſeth from the ſecond and third bones. The vſes of the bone *hyois*

The muſcles alſo of the *Larynx* take their originall from hence: the *anterior*, that is to ſay, the beginning of the firſt and fourth payres of the foure common muſcles from the lower part of the firſt bone: and thus wee ſee howe the bone *Hyois* was ordayned to eſtabliſh the muſcles of the tongue and the throttle. And ſo much of the bone *Hyois*, now we proceed.

CHAP. XX. *Of the Spine in generall.*

WEe deuided the *Sceleton* before into three partes, the Scull, the Trunke and the Ioynts. The Scull we haue proſecuted as narrowly as we could; the Trunk we alſo deuided into the Spine, the Cheſt, and the Bone without a name. Vnder the name of the Spine we comprehend all that which is extended from the firſt Racke-bone of the Necke vnto the *Coccyx* or Rumpe: and this the Grecians call ῥάχις, becauſe the backepart of it is ſharpe and ſpinie. It is called alſo *dorſum* or the Backe, becauſe the Backe is the greateſt part thereof.

This Spine is the habitation or ſeat and defence of the Marrow as the Scull is of the Braine. For becauſe the dignity or woorth of the Marrow of the Spine is equall to the worth of the braine (for it is the originall of all the ſinnewes excepting ſeauen coniugations, and therefore is called the Braines Vicar or Subſtitute) Nature was no leſſe carefull of the preſeruation thereof then ſhe was of the Braine it ſelfe. As therefore the Brayne was compaſſed with the bones of the Scull as with a Helmet, ſo the Spinall Marrow is walled in on euery ſide by the Racke-bones of the Chine. What the ſpine is. The dignity thereof.

This that Nature might the better accompliſh, firſt ſhe hollowed the Spine throughout, then ſhe exaſperated it with many proceſſes both acute and tranſuerſe, thereby as it were flanking the bulwarke againſt all annoyance. The cauity is large, the better to containe the Marrow, in which reſpect the whole Spine is called σύριγξ ἱερὰ the *Sacred Pipe*, by *Herophilus* the Canale. The Spine therefore is bony, not made of one but of many compacted together, as well to helpe the variety of motions becauſe it was fitte the creature ſhould moue forward and backward, as alſo to preuent danger; for the luxation ſaith *Hippocrates*, of one Rack-bone is more dangerous then of many, becauſe it conſtrayneth the Marrow into an acute angle, and ſo doth neceſſarily either breake it or compreſſe it very ſore. Why the ſpine is hollow.

Theſe Bones that make the Spine are called σπόνδυλοι from the ſimilitude the haue with the whirle of a wheele. They are alſo called *vertebræ*, becauſe by them the body is *turned* into diuers parts. *Pliny* calles them *oſſa orbiculata* round or *Nut-bones*. This Spine is the *Baſis* and foundation of the whole building, and therefore the auncients compared it to the carkaſſe of a Ship, for as the crooked ribbes and elbowes of a Shippe are faſtned to the bulke, and afterward the prow and the ſterne or caſtle are annexed, right ſo the ribbes the Armes and the Legs are faſtned to the Spine. Why made of manie bones.

The figure of the Spine *Hippocrates* firſt elegantly expreſſed in the third Section of his Booke *de articulis*, and in his Booke *de natura oſsium*, where he ſayth it is ἰθυτενόλιος, that is, *after a manner direct or ſtraight*: yet ſo that it inclineth ſometime backeward ſometime inward. From the firſt Rackbone of the Necke vnto the ſeuenth it inclineth inward that it might ſupport the Gullet and the rough artery. From the firſt Racke of the Backe vnto the twelfth it beareth outward, to leaue more ſpace for the organs of Reſpiration, that is, for the Heart and the Lungs. The Loynes incline inward to ſupport the deſcending The figure of them

trunkes of the hollow veine and the great artery. The holy-bone protuberateth outward with a kinde of rectitude or ſtreightneſſe to make the capacity of the *Hypogaſtrium* or water-courſe better able to conteine the bladder, the right gut and the wombe.

We alſo will add, ſaith *Laurentius*, that the fore and inner part is equall that it might not offend the bowels yet ſcored throughout with tranſuerſe inſcriptions: the backeſide is vnequall for the better inſertion of muſcles, and the ſafer egreſſe of the veſſels.

4 parts of the Spine.

The Spine may be diuided into foure parts, the Necke, the Backe, the Loines, and the Holy-bone. The Rackes of the necke are ſeuen, of the backe twelue, of the Loines fiue, whoſe articulation and coalition is ſtrange and wonderfull. The articulation is double, forward and backward; the forward articulation is made by the bodies of the Spondels, and is more ſtrict and cloſe: the backward or hinder articulation is made by the oblique proceſſes and is more lax or remiſſe, partly that the creature might moue more eaſilie forward, partly leaſt in bending backward the veſſels ſhould be diſtended, compreſſed, or broken. In a word, there are ſixe articulations of the rackbones, two by their bodyes, and foure by their oblique proceſſes aſcending and deſcending. That articulation which is made by the proceſſes belongeth to *Ginglymos*, for euery racke (excepting the firſt and the eleuenth) receiueth an vpper and is receiued by a lower, ſo that for the making of the *Ginglymos* there muſt be three rackes.

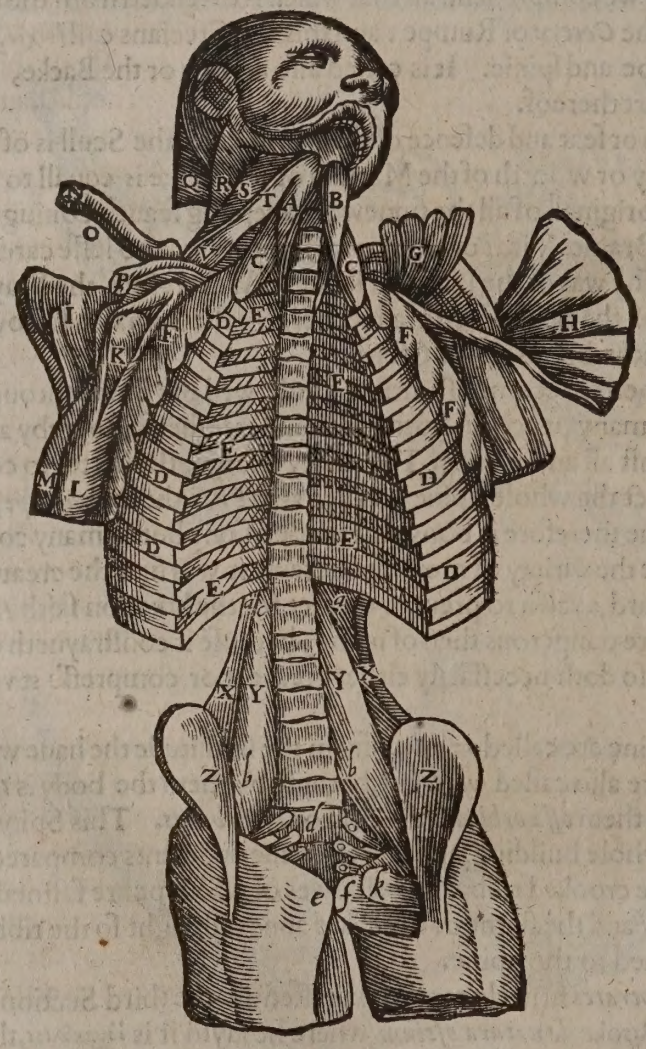
The artic tion of the Rackes.

The *Symphyſis* or coalition of the Rack-bones is not *Griſtle bound*, although their extreamities bee lined ouer with a griſtle, but by Ligaments and thoſe very ſtrong, ariſing from the bones, from the griſtles, and from the membranes that inueſt the bones.

TABVLA XII.

See this Tables deſcription, in fol. 771.

What the Rackbones haue in common.



All the racke-bones of the Spine haue many thinges in common. Firſt euery rack hath his body ſeated on the inſide thicker and more fungous thē the reſt of the bone, to which alſo Appendices do grow & griſtles. It is broade both in the vpper and in the lower baſis to make the articulation more ſecure leaſt it ſhould lux ſideward. Againe, euery racke hath a large hole wherein the narrow is contained, and this perforation is in all the rackes equall, ſaith *Laurentius*, for he neuer could obſerue it larger aboue or narrower below, although ſome haue thoght the contrary. But, ſaith *Laurentius* although the wonderfull fruitfulneſſe of the Marrow of the backe in propagating Nerues be by degrees diminiſhed, yet thoſe lower cauities are filled vp with thicker Membranes, prepared more ſtraitely to vnite the thicker Bodyes of the Spondels. Thirdly, in euery rackbone there are three kinds of proceſſes, oblique, tranſuerſe and acute. The oblique are foure, two in the vpper part and as many in the lower; the vpper aſcending, the lower deſcending, and by theſe are the Hinges of the backe hung together, for the articulation is made by *Gynglimos*.

The tranſuerſe proceſſes are two, made to ſecure their muſcles and for their originals and inſertions. The acute proceſſe is ſingle, ſeated in the backepart, and giueth the name

vnto

vnto the whole, for it is called ῥάχις or the *Spine*, and this is wanting onely in the first Racke.

Fourthly, in euery Racke-bone there are fiue Appendices, two in the body, two in the transuerse processes, and one in the Spine.

Finally, euery spondell which is articulated with another, hath a perforation which affordeth an outlet for the nerues, produced from the Marrow. Notwithstanding this perforation is not after the manner in all the Racks, for in those of the Neck the lower is deeper then the vpper: in the spondels of the Backe, the semicircle of the vpper and the lower is equall: in the *vertebræ* of the Loynes the whole cauity almost is formed by the vpper. And these things are common to all the Racke-bones. Now in their particular history wee shall see what is proper to euery one of them; but first you shall haue a Table to shew you all the Rack-bones of the Spine from the top to the bottom.

CHAP. XXI. *Of the Rack-bones of the Necke.*

THE vse of the whole Necke and his admirable structure doeth not belong to this place, and of it we haue spoken before: here wee haue to doe onely with the Bones, which are commonly seauen [table 13. fig 2.3.4.] differing both amongst themselues and from the other Racks of the Spine.

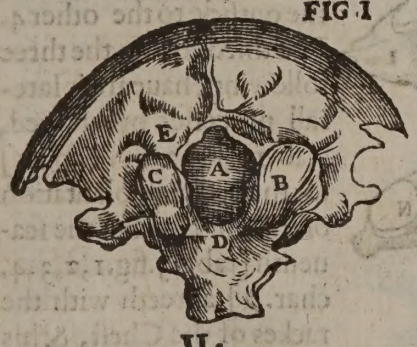
The two first are ioyned to the Nowle by Ligaments, whereby the head is strongly fastned to the necke. The first of these [ta.13.fig.2.3.4.[ff] ta.14. figu.2.3.4.] is called *Atlas*, because as he was imagined to hold Heauen vppon his shoulders, so this especially beareth vp the Head. The body of it is more slender but faster then the rest, and it wanteth his vpper processe or his Spine, least it should haue hurt twoe small muscles of the head: but ascending and descending processes it hath like the other Racke-bones, which in this are hollowed on either hand [tab. 14. fig. 2. 2.[ff]] Aboue to receiue two processes [ta.13.fig.1.[z c]] of the nowle-bone to help the motion of the head. *Galen* thought in compasse, but *Colũbus* reproueth him who sayeth that by this articulation the head is inclined and reclined, that is, moued forward and backward. Below it receiueth the processes of the second Rack-bone. [tab. 14.fig.5.and 6.[MN]] It hath also at the sides two transuerse processes [tab.13.fig. 2.3.II ta.14.fig.3.4.[c o]] perforated [tab.13.fig.2.[x] tab.14.fig:2.[x] sheweth the hole] for the ascent of a veine and an artery into the braine.

7 Racks of the necke.
1 *Atlas*.

It hath also a *sinus* or bosome [t.14.fig.2,3.[B]] crusted ouer with a gristle [fig.3.4.[c]] the better to receiue the tooth [fig.7 O] of the second racke,

TABVLA. XIII.

FIG I

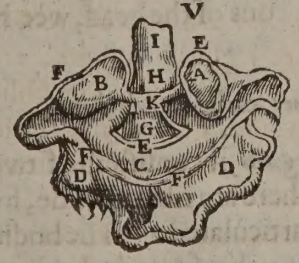


II.

III.

IV

V



VI

See this description lib.6.fol.397

racke,

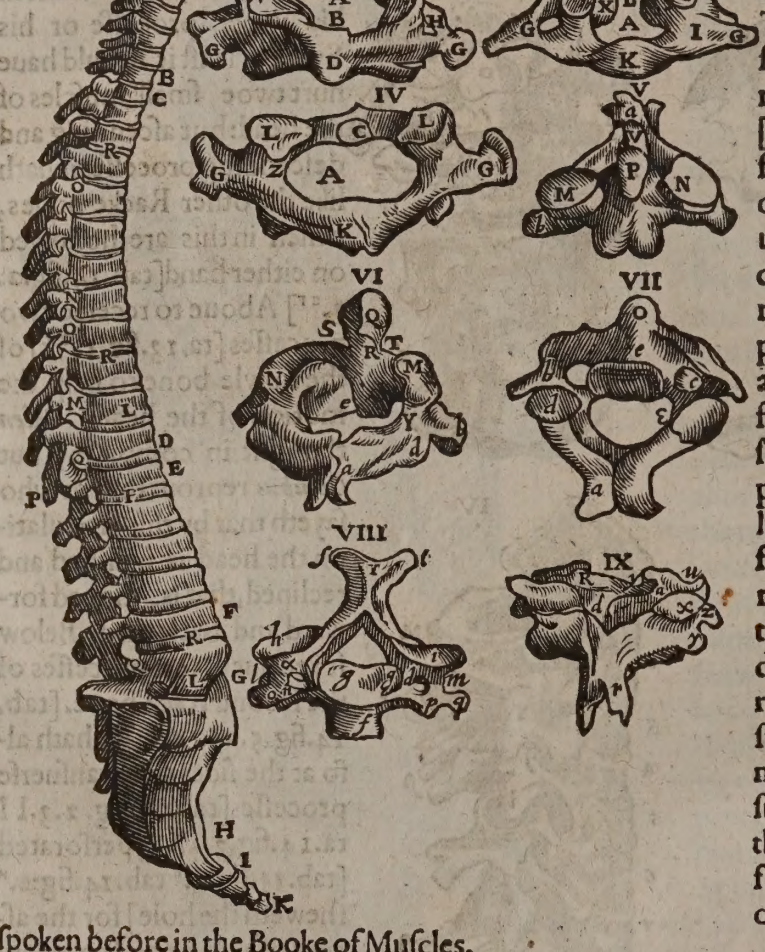
racke, and at the proceſſes where the rackes are ioyned there is a ſinus on either hand: in the firſt [fig.4 z] and the ſecond [fig.6 y] bearing the forme of a rift or cleft. In the other rackes it is orbicular, ſauing that in the Cheſt it is ſomewhat long. Through theſe ſinus are conueyed coniugations of ſinewes and branches of Veines and Arteries, miniſtering nouriſhment to the marrow and to the bones.

The ſecond Racke [Tab.13. fig.2,3, N tab.14.fig.5,6,7] beſides his bodye, his laterall proceſſes [tab.14.fig.5,6,7 b] ſhort and perforated with an oblique hole, [fig.7. s] his Poſterior proceſſe byfurcated in reſpect of the muſcles, [figu. 5,6,7 a] his aſcending proceſſes lightly bunching out, and his deſcending [tab.13.fig.2 R. tab.14,fig.6,7, d] lightly ſinuated; beſide all theſe, I ſay, there yſſueth out of the middle of his body an appendixe (commonly called a proceſſe) round and long, [tab.13,fig.2,3,4 O. tab.14. fig.6, o. fig. 7,O] which becauſe it is like the Dog-tooth of a man, is called the Tooth. *Hippocrates* calleth the whole Racke the tooth, and in the luxation therof, ſaith he, happeneth the moſt incureable Squinſey. This Appendix is ſomewhat rough in the ſurface, that from thence a Ligament might yſſue [tab.13.fig.5 t] by which it is faſtned to the Nowle; about it alſo is caſt a ſolid and round [tab.13.fig.5 x] ligament to keepe the marrow from compreſſion. Moreouer this ſecond racke is ioyned to the firſt by a broad Ligament [tab.14. f. 5 r] which is orbicularly caſt round about it.

TABVLA XIIII.

See this Tables deſcription, in lib.6. Fol.398.

FIG. I



The third Racke-bone, [Tab.13.fig.2,3 SS. tab.14 fig.8 and 9] is called ἄξων. It is ioyned moſt ſtrictly and exceeding firmelie on the outſide to the other 4. The third, as alſo the three following, haue their laterall proceſſes byfurcated, [tab.13,fig.2 V,V. fig.4 e] for the better implantation of the Muſcles; but the ſeauenth [tab.13.fig.1,2,3,4, char.7] agreeth with the rackes of the Cheſt, & his poſteriour proceſſe is not alwayes byfurcated [ta. 13. figure 24 X] but whole and ſound: his body belowe is plain, that it might equally be ioyned to that which followeth. Finallie, all the rackes of the necke excepting the firſt haue Appendices, betwixt which doe run thicke and ſofte Griſtles for their more facile motion. And ſo much ſhal ſuffice to haue ſpoken of the rack-bones of the neck; for concerning the motions of the head, wee haue ſpoken before in the Booke of Muſcles.

3 and the reſt

CHAP. XXII. *Of the Rackes of the Backe and the Loynes and the Holy-bone.*

How the rackes of the necke and the backe differ.

THe backe is called in Greeke νῶτον, in Latine *tergum*, it conſiſteth of twelue rack-bones, [tab.14.fig. 1 at D] iuſt ſo many as there are ribs on a ſide, for to euery rack-bone are two ribs [tab,15.fig. 5 DD] articulated. The bodies of theſe Rackes as alſo their proceſſes do differ ſomewhat from the bodies and proceſſes of the rackes of the Neck. The bodies of the necke are long, broad and

and equall, that vpon them the Gullet and the Rough Artery might leane more securely.

The bodies of the backe are round, conuex or embowed, thicker also and not so solid. The spinall processes of the necke are byfurcated, those of the backe are long, simple and do bend downward. The transuerse processes of the necke are broad and perforated. Of the backe, thick, solid and round, to make the articulation of the ribs more firme, excepting the eleuenth and the twelfth, to which the last and the shortest ribs are fastned, that there might bee more space left for the Liuer, the Spleene, and the parts thereunder.

Of the twelue Rackbones of the back, sometimes but rarely there is one wanting, more rarely is there one too many, yet for the most part dogs haue one more then men. They were made many for the better flexion of the spine, and are fastned together with strong Ligaments, [tab.14.fig.1 RR. ta, 15.fig.6 ch.5] yet there is a good quantity of gristle betwixt each of them. [Tab.15, fig.6. char.1,2]

The first tacke of the backe is called by the Ancients λορία because it standeth out beyond the rest; the second is called μασχαλιστὴρ, that is, the Axillary spondell: the eight following πλευρίται, that is, *Costales* belonging to the ribs. The eleuenth [ta.15.fig.3] called ἄρρεπτος, because his spine is right, and this like a naile fasteneth the other rackes. *Laurentius* addeth, that it is quite contrary to the first, for the first receiueth and is not receiued, this eleuenth is receiued but doth not receiue. The twelfth is called [t.15.fig.4] διαζωστὴρ, the compassing spondell. The first.

These Rack-bones haue in the middle protuberating, round and embowed bodies, [tab.15.fig.1] aboue and below [tab.15.fig.1,2,3,4 A] plaine, thicker then the Rackes of the necke and lesse solid; full also of small perforations for the transportation of the vessels that carry the nourishment. Their spinall processes [ta.15.fig.1 and 2 N O P] are long, simple and accute looking downward: the transuerse also [tab.15.fig.1,2,3,4, H I] for the firmer articulation of the Ribs are crasse, solid and long, determining into a round head. Their Figures

They haue also ascending processes two [tab.15, fig.1 T V] & as many descending. [tab.15, figure.2,3 a b] The transuerse processes of the eleuenth and twelfth racks [tab.15.fig.4 e f g h] do differ from the processes of the other spondels, which variety *Galen* attributed to the tenth racke, for in a Dog or an Ape the tenth is the mid dlemost, but in a Man the twelfth.

They haue also fiue Appendices, two at their bodies aboue [tab.15.fig.3, φ] & below; two at the transuerse processes, and one at the extremity of each spine They haue also two sinus or bosomes; [tab.15.figu.1 from C to D], one at the sides, another in the Transuerse processes, both small & answerable to the heads of the ribbes, for into them the ribs are articulated. The holes of these Racke-bones [Table.15.figu.2,3,4 °] are proportionable to the marrow which they containe, and though *Laurentius* will not agree therto, yet *Bauhine* conceyueth that the matrow is attenuated in the descent, and so the holes of the lower rack-

Appendices;

TABVLA. XV.

See this Tables description in Lib.6. Fol.393.

bones

bones become ſtraiter. And ſo much of the backe.

The Loines make the third part of the ſpine, and do conſiſt of fiue Spondels [ta.16.fig. 12 from [b] to [c]] the greateſt and thickeſt of all the reſt which are faſtened by Griſtles and thicke Ligaments; aboue, with the rackes of the Cheſt or the backe, [tab.16.fig.2 [a] ſheweth the laſt racke of the backe] below, with the Holy-bone, [tab.16.fig: 1 & 2 [c]] for they lye vpon them, and are articulated by the intetpoſition of a Ligamentall griſtle; yet ſo, that the motion of the Loines is more lax and diſſolute then that of the backe: the Reaſon was, becauſe we might better incline our ſelues vnto the earth.

The firſt Rack of the Loynes is called νεφρίτης from the Kidny which reſteth it ſelfe vpon it. The laſt is called by ſome ἀσφαλίτης, that is, the ſupporter or the ſtrengthner.

The Rackes of the Loynes, beſide their lateral perforations made for the tranſmiſſion of the Nerues, are alſo thrilled through with ſmall holes.

Their proceſſes are Aſcending. [Tab.16.fig.4 & 5] Deſcending [fig.4 [N]] & tranſuerſe, [fig.2 [ee] fig.3,4,5 [N]] longer and ſlenderer then in the reſt: but their acute proceſſes which they call the *Spine* [tab.16.fig: 3,4,5 C D] are thicker then in the reſt and broader, that to them the Ligaments and muſcles of the backe might be faſtened. The Spondels alſo of the Loines (ſaith *Laurentius*) haue proceſſes like a Medlar ſtone, which is found ſometime in them all, ſometimes onely in the vppermoſt. And ſo much of the Loines.

The Holy-bone, called *Os ſacrum* and ἱερὸν, not becauſe it containeth in it any ſacred and hidden myſtery, as ſome haue fondly imagined, but becauſe of his greatneſſe, for it

Table 16, figu. 1. ſheweth the anterior part of the bones of the lower belly.
Fig:2. The poſterior parts.
Fig.3,4,& 5 do ſhew one of the Rackbones of the Loynes.
The third figure his fore-part, the fourth Figure his backepart, the fiſt figure his ſide.

TABVLA XVI.

a 2, The laſt racke-bone of the ſpine.
From *b* to *c* 1,2. The fiue rackebones of the Loynes or of the Rheines.
From *c* to *d*, 1,2. The broad Holybone.
d 1,2. The hip bone or the *Coccyx*.
ee 1,2. The laterall proceſſes.
f, 2. His poſterior proceſſe or the Spine.
g, 2. The vpper proceſſe.
b 2, the lower.
ii, 1,2. The plainer or bunching part of the *Coxa*.
k 2, His loweſt proceſſe.
ll, 1,2. A boſome or cauity in the lower part of that bone.
mm 1,2. The hanchbone called *Os Ilium* and *Lumbare*.
nn 1,2, the ſharebone *Os pubis*.
qq 1, the hole of the ſhare-bone.
AA, 3,4,5. The vpper appendix of the body of the racke.
B, 3,4. The lower Appendix.
C, 3,4,5. The vpper part of the ſpine of the racke of the Loynes, or a broad & rough line.
D 5 the lower ſeat of this ſpine or the lower line.
E 5, A ſinus or cauity at the ſide of the line D.
F, G, 4,5. The appendixe of the ſpine reſembling a triangle.
H 3,4,5 A tranſuerſe proces on either ſide
I, 4. The right aſcending proceſſe.
K, A ſinus of the left aſcending proceſſe.
L, M, 4,5, the browes of this ſinus before and behinde.
N 4, The deſcending proceſſe of the other ſide.
O, 4,5. The head of that deſcending proceſſe.

is the greateſt of all the bones of the Spine, ſo *Homer* calleth great Fiſhes *Piſces ſocros*; and *Hippocrates* for the ſame reaſon calleth this Holy-bone *vertebram magnam* the *Great rack-bone*. It is alſo called πλατύ the broad bone. The figure of it is almoſt triangular, hauing

ning a broade beginning, and ending by degrees into a narrownesse. Immoueable it is and maketh the *Basis* of the backe. *Galen* sayth it consisteth of three bones, by which hee vnderstandeth the three first, but the trueth is, that it is made of fiue bones [tab.10.fig.1.& 2.from c to d ta.17.fig.6.from A to F] as it were of proper rackes knitte and fastned together by gristles, which in growne bodies are so fast glewed that it seemeth to be but one bone, whereas in children the gristles betwixt the bones are very euident.

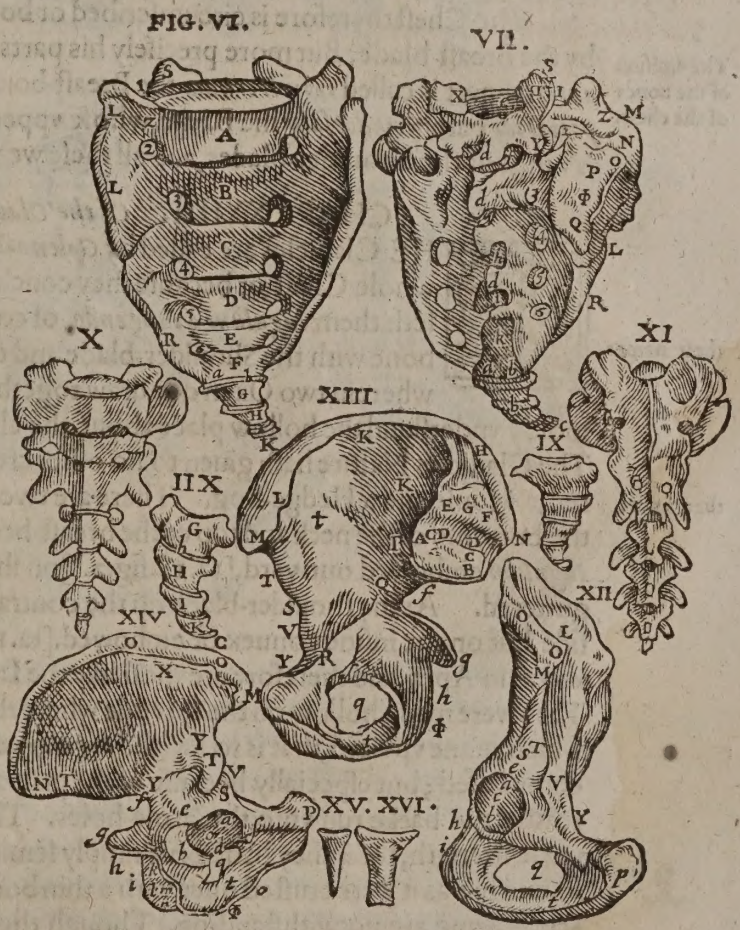
This Holy-bone on the foreside is hollow, smooth and equall; behind it is incurued or gibbous, rough also because of the Ligaments and the muscles of the backe. His acute processes are very small, the transuerse [ta.17.fig 6.and 7.K] but obscure, and determining into a cauity shallow, vnequall and rough, which receiue the hanch-bones: ascending processes onely the first racke of the Holy bone is allowed [tab.17.fig.6.7.S] by which it is articulated with the descending processes of the last spondels of the Loynes. In the sides of the three vpper bones there are certaine *Sinus* or bosomes insculped, to which the hanch-bones doe so cleaue and are articulated [table 17.figu.7.M] that they seeme to grow together.

It hath also Spines [table.17.fig.7.dddd] looking downeward, which in the fift and sixt bones are deuided into two parts. The perforations of this Holy bone [ta.17.fig.6.and 7. char.1.2.3.4.5.6 shew the holes of the nerues; fig.7.efghik shew the holes for the marrow] are before and behind, not on the sides as in the other Rack-bones, because the haunches do occupy them, and the *anterior* are greater then the *posterior*, because greater nerues are distributed into the fore parts and into the hind parts.

At the end of the Holy-bone appeareth the Rumpe-bone called *Os Coccygis*, [tab.16.

Table 17. Fig. 6. sheweth the fore side of the Holy-bone & the Rump. Fi. 7. the backeside. Fig. 8. the Rumpe-bone of a man curued forward. Fig. 9. the Rump bone of a woman curued backeward. Fig. 10. sheweth the foreside of the Holy and Rump-bones of an Ape. Fig. 11. their backeside.

TABVLA XVII.



From A to F 6. The sixe parts of the Holy bone placed vnder the fift racke of the Loynes.

From G to K 6,8, foure bones of the *Coccyx* or rumpe which cleaue to the Holy bone.

L L 6,7, The large transuerse processe of the second Holy-bone, for the rest as farre as R are by degrees angustated or straytned.

M 7, an vnequal bosom of the Holy bone to which the right hanch bone is ioyned.

N 7, the *exterior* part of this *sinus* which is the plainer.

O 7, a long protuberation distinguishing this *exterior sinus* from the *interior*, noted with Φ.

Φ 7 the *interior sinus* vnequall.

P Q 7, the vpper and lower part of this *sinus*.

R 6,7, a swelling of the transuerse proces whereto a ligament is ioyned.

S 6,7, The ascending processe of the first bone. T 7, a *sinus* of the processe receiuing the head of the descending processe of the fift racke of the Loynes. V X 7, the browes of this *sinus* on either hand. Y 7, The connexion of the descending processes of the first bone, with the ascending processes of the second bone. Z 6,7, the coniunction of the transuerse processes of the first and second bones. *a b* 7, the connexion of the Holy-bone with the Rumpe. *b b* 6,7,8, a gristly ligament comming betweene the loose connexion of the Rumpe bones. *c* 7,8, a gristle growing to the end of the Rumpe bone. *d d d d* 7, the spines of the Holy-bone. *e f g h i k* 7, Holes betwixt the distances of the spines made for the transmission of the spinall marrow. 1,2,3,4,5,6, in fig.6,& 7, holes through which the Nerues of the Holy-bone doe passe.

fig.

fig.1.and 2.d tab.17.fig.8.and 9.]becauſe it is like a Cuckoos beake. *Galen* calleth it an *Appendix*,and vnder that name vnderſtoode the three lower bones that belong to the Holy-bone.

This Rumpe conſiſteth of three or foure bones[ta.17.fig.6.and 8.from ° to x]and two griſtles. One where it is faſtned but looſely to the Holy-bone[tab.17.figu.6.and 7.t]that it might yeeld backeward when the thicker excrements are auoyded, and when wee ſitte downe returne forward into his place. In men it is curued or bent more inward to ſuſtaine the right gut, but in woemen outward,becauſe of the necke of the wombe. The ſecond griſtle is at the very extremity or end of it,[tab.17.fig.3.and 7.c] ſometimes alſo it is placed betwixt his firſt and ſecond bones.

That this Rumpe-bone in the time of the birth is retracted or drawne backward, we doe no more doubt ſayeth *Laurentius* then wee thinke it impoſſible that at that time the ſharebones ſhould be diſioyned. And thus haue we brought to an end the Hiſtory of the Spine which we made the firſt part of the Trunke. Now we proceed vnto the Cheſt.

CHAP. XXIII. *Of the bones of the Cheſt in generall.*

THE ſecond part of the Trunke is called *Thorax*,a word which ſignifieth to leape,for the heart therein contayned is moued with perpetuall ſubſultation. Wherefore becauſe it contayneth ſo noble a bowell,ſo neceſſary for the maintenance of life, therefore Nature hath defended it with bones. But againe becauſe in Reſpiration it muſt continually bee diſtended and contracted,therefore it was made alſo partly fleſhy. The fleſhy part wee haue deſcribed in his proper places,that is to ſay,in the ſixt and tenth bookes. The bony part though we haue touched before in the ſixt booke,yet becauſe it pertained properly to this place, we will attend it here more diſtrictly.

The diuiſion of the bones of the cheſt.

The Cheſt therefore is circumſcribed or bounded out aboue by the clauicle,below by the Breaſt blade. But more preciſely his parts are *anterior* or *poſterior* or *laterall*. The *anterior* part is called στῆθος *ſternum* the Breaſt-bone : the ſides πλευραὶ *coſtæ* the Ribs : the *poſterior* part νῶτον *dorſum* the Backe,whoſe vpper ſides are called ὠμοπλάται & πτερύγια the Wings or the Shoulder-blades,and all theſe we will deſcribe in their order.

CHAP. XXIIII. *Of the Clauicles or Coller Bones.*

their names.

THE Clauicles are called by *Galen* κλεῖδες becauſe they cloſe or ſhutte vp the whole Cheſt,or becauſe they conclude the Arme and the Necke. *Celſus* calleth them *Iugulum a iungendo*, of coupling, becauſe they couple the Breaſt-bone with the Shoulder-blade and the Arme,for they are very like the yoke wherein two Oxen doe draw together, but by the name *Iugulum* wee commonly vnderſtand the hollow place aboue the clauicles where they vſe to ſticke a Swine.

their figure.

The Clauicles Nature hath giuen to no other creature ſauing to a Man,an Ape, a Squirrell,a Mouſe and a Hedge-hog. There are two, one on each ſide,ſeated ouerthwart in the bottome of the neck and top of the breaſt-bone. Their figure is not ſtreight,but at the *Iugulum* embowed outward,[ta.18.fig.2.x]on the inſide they are concauous or as it were guttered. At the ſhoulder-blade on the contrary they are lightly hollowed on the outſide,but on the inſide conuex or embowed.[ta.18.fig.1.2.3].In men they are not ſo crooked as in Apes,and therefore are moſt like the Latin letter *f*,but in Apes more like the S. They were made hollow on the foreſide where they regard the *Iugulum*, that the veſſelles which runne vpward,that is to ſay,the *Iugular* veines and the ſleepy arteries might not be compreſſed ; but eſpecially becauſe of the propagations of ſinewes,which from the marrow of the backe run vnto the arme-holes. They haue in them a double ſemicircle for more ſtrength, for if they had beene ſimply ſemicircular being fiſtulated and ſpongy within,and but as it were cruſted ouer with a thin bony ſcale,they might eaſily haue been broken,yea and are notwithſtanding. Though theſe bones are long,craſſe and crooked,yet they are more crooked in men then in women,that the motion of a mans arme might be at better commaund;but in women [ta.18.fig.4.x] they are leſſe curued and ariſe higher;

How they differ in men and women.

hence it is that women are ſo auckward when they throw a ſtone or ſtrike a ball, but Nature made recompence,for her necke is ſo much the more beautifull and ſtately built,becauſe there is no ſuch hollownes in it as is in a mans.

Their protuberations.

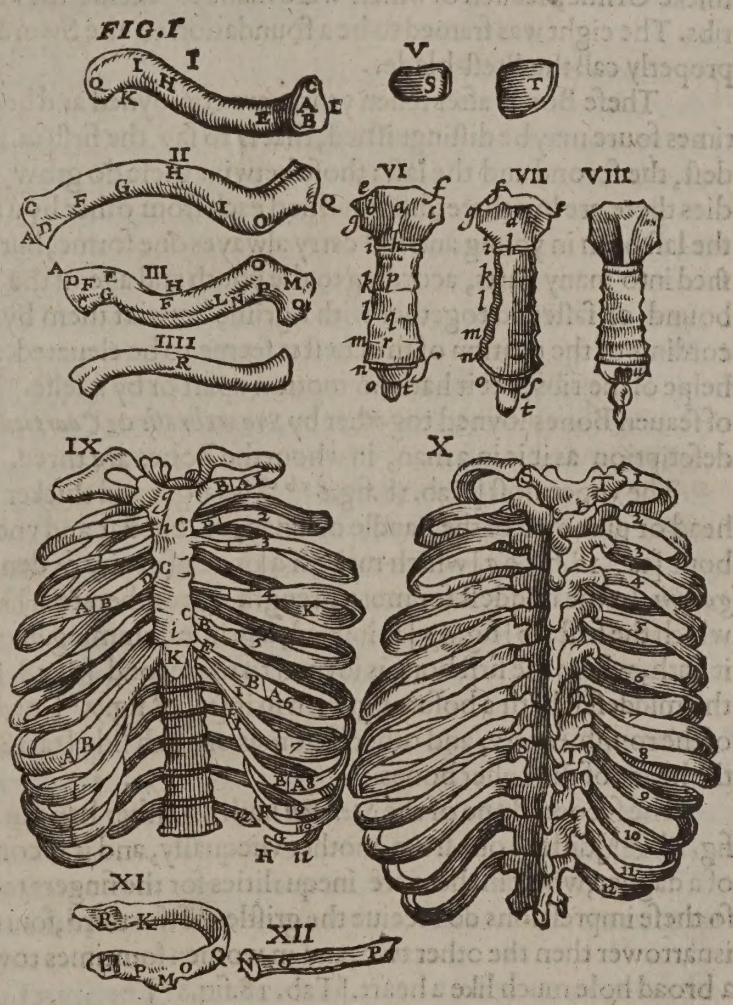
They bunch ſomething forward, and haue two riſing lines in them [ta:18.fig.1,3 x fig. 2 x o] from which the *ſubclauian* muſcle and a part of the pectorall muſcle do ariſe. They haue

haue alſo a knub or protuberation from whence ariſeth a Ligament which goeth to the inner proceſſe of the ſhoulder-blade. [tab. 18.fig.3. It ariſeth about ᴺ] Neere their endes they are alſo on both ſides exaſperated, and from that roughneſſe proceede Ligaments, and the muſcle called *Maſtoides* or the ſeuenth of the heade. But where the Clauicle is broad, there it affoordeth an originall to the muſcle *Deltois*, and inſertion to the ſecond muſcle of the blade.

Theſe Coller-bones faſten on both hands the ſhoulder-blades with the breaſt-bone by *dearticulation*, yet there commeth betwixt them a large griſtle [tab. 18.fig. 5 ˢ ˣ] which is moiſtened with an Oyly humor. And this griſtle is called κατακλεὶς *clauſura*, becauſe it cloſeth them together, yet doth it not grow vnder them, but is onely held downe by the Ligaments that compaſſe the ioynt, that in the motions of the arme and the ſhoulder it might giue a little way.

TABVLA. XVIII.

See this Tables deſcription, in lib.6. fol.393.



It hath two heades, one ſmaller, cruſted ouer with a griſtle [tab.18. fig:1, 2,3, ᴬ] whereby it is ioyned to the breſt-bone as we ſayd: the other is broade and ſomewhat long [ta, 18.fig. 1.2,3 ᴳ] by which it is articulated to the vpper proceſſe of the ſhoulderblade by the interpoſition of a peculiar griſtle, which *Galen* calleth the ſmall griſtly bone, made ſaith he, for the ſecurity of the ioynt.

The vſe of the Collerbone is, that the Blade ſhould not together vvith the arm fal vpon the breſt, and ſo many motions of the arme be forfeyted. It is true indeed that theſe bones may ſeeme not to belong vnto the Cheſt, beecauſe all brute beaſts haue Cheſtes, but very fewe of them theſe bones. We anſwere, that Nature is moſt Wiſe in her adminiſtrations and hath therefore giuen theſe bones vnto men becauſe they haue hands, which it concerned them much diuerſly to mooue into manie poſitions from one ſide to another. Now becauſe in ſuch flexions the arme ſhould not fall hedlong as it were into the oppoſite ſide; and when it is voluntarily bent or with violence mooued that way, might yet be able to recouer it ſelfe, or to ſtay his fall, therefore the clauicles were ſet betwixt the two ſides to inhibite or preuent any ſuch ouer-extent: againe, were it not for the Clauicles when wee offer to thruſt any thing ſtrongly backeward, the blade would fall forward, as ſometimes the arme falles vpon the ribs when it is luxed or put out of ioynt, or when the blade hangs downe like a wing, as it will do when the Coller-bone is broken. And thus much concerning the Clauicles.

Their vſe.

CHAP.

CHAP. XXV. *Of the Breſt-bone.*

The Names, THe Breſt-bone is the forepart of the Cheſt, and called in Greek στέρνον, either becauſe [ta.18. fig.9. g h i] it is diſpoſed in the middle of the ribs, or becauſe there is τὸ στερρὸν τῆς νοῦ *Mentis firmitas*, becauſe the heart lyeth vnder it. *Hippocrates* calleth it στῆθος, the Latins *Pectus* or *os pectoris* the breſt-bone, becauſe it maketh the forepart of the breſt, and ſafegardeth the noble partes therein contained. This Breſt-bone is ſomwhat conuexe or embowed, long alſo or broad, and becauſe it is like the handle of a dagger ſuch as was vſed in olde time, it is called ξυφοειδὲς.

Subſtance. The ſubſtance of this bone is not ſolid as other Bones are but fungous and reddiſh, compounded alſo of Bones and Griſtles: for it is not one bone, vnleſſe it be in very olde men, otherwiſe if you ſcrape off the membranes, you may ſee it is compacted of many. In Infants new borne it is altogether griſtly excepting the firſt bone of it, a little after ther may

Number of Bones be obſerued eight diſtinct partes, each of them diſtinguiſhed from other by a large and thicke Griſtle, ſeauen of which were made to receiue the articulation of the ſeauen true ribs. The eight was framed to be a foundation to the Sword-like Cartilage, which wee properly call the Breſt-blade.

Theſe Bones after ſeuen yeares are conioyned and begin to grow fewer, yet ſometimes foure may be diſtinguiſhed, that is to ſay, the firſt [ta.18.fig.6 *a*] which is the broadeſt, the ſecond and the laſt: thoſe betwixt theſe do grow into one, but in growne bo-

The firſt. dies there are but three, diſtinguiſhed each from other by a tranſuerſe line. The firſt and the laſt both in young and old carry alwayes one forme, but the middlemoſt is diſtinguiſhed into many parts, acording to the youth and age of the party, which parts are griſtle bound or faſtened together with a griſtle betwixt them by *Coalition*. For although according to the motion of the cheſt it ſeeme to be eleuated and againe depreſſed by the helpe of the ribs, yet it hath no motion apart or by it ſelfe. In dogs it conſiſteth alwayes of ſeauen Bones ioyned together by *Synarthroſis* or *Coarticulation*. But we wil follow the deſcription as it is in a man, in whom the Bones are three.

The vppermoſt [Tab.18.fig.6 a b c] is larger and thicker then the reſt, and is like the head or pummell of the handle of a dagger, but flat and vnequall; horned or creſcent aboue [tab.18.fig.9 *g*] which maketh a kinde of cauity or den which ſome haue called *Iugulum*. In the middeſt for more ſtrength it protuberateth like a triangle [tab.18.fi. 6 *a*] at which the firſt rib [fig.6 *g*] is ioyned, a griſtle comming betwixt them. A ſecond griſtle it hath, where the firſt bone is ioyned to the ſecond. [ta.18. fig.6 h] On the inſide about the middeſt it hath a boſome grauen in it [ta.18.fig:7 d] made to giue way to the deſcent of the rough Artery, and other boſomes on each ſide [ta.18.fig, 6 & 7 e f] which receiue the heads of the coller bones.

The ſecond Bone of the *Sternon* hath on either hand in the ſides many cauities [t.18

The ſecond. fig. 6 k l m n] diſtant one from another vnequally, and it is compared not amiſſe to the haft of a dagger, wherein there are inequalities for the fingers to take faſt hold vpon, for euen ſo theſe impreſsions do receiue the griſtles of the third, fourth, fift & ſixt ribs. This Bone isnarrower then the other two, and in women ſomtimes toward the end perforated with a broad hole much like a heart. [Tab. 18.fig.8 u]

The third Bone is leſſe but broader then the ſecond [ta.18. fig. 6 and 7 r] wherefore

The thirde. *Celſus* wrote that the Breſt-bone was horned or creſcent at both ends; but you muſt vnderſtand him of a man and not of a dogge. Heereto is ioyned the griſtle of the ſeuenth rib iuſt where it ſelfe is faſtened vnto the ſecond bone, and in ſome bodies it is diuided in the middeſt by a line.

The Griſtles of the Breaſt-bone. On both ſides this *Sternon* is ſmooth, ſauing that aboue it is ſomewhat exaſperated to giue an originall vnto the muſcle *Maſtoides* or the ſeuenth muſcle of the head. Griſtles it hath, (beſide the two vpper which go betweene the coniunction of it with the Clauicles) one betwixt the firſt and the ſecond bone [ta.18.fig.6, 7 h] which ſupplieth the place or doth the office of a Ligament. Another in the end, long, mooueable, and triangular [t.18.fig.6 & 7 t] which commonly is ſharpned like the point of a ſword, whence it is called ξυφοειδὴς, *Enſiformis* and *Mucronata*, the *Blade of the Breſt*; this alſo is ſometime broad in the end, ſometime byfurcated, and therefore ſome haue called it *Furcella*, the *litle forke*. Oftentimes it is round, ſometimes double, ſaith *Laurentius*, and the leſſer part lyeth vpon the greater, as the leaues of the Herbe called *Horſetoung*: ſometime alſo it is perfora-

ted

ted [ta. 18. fig. 8 *u*] to transmit the Mammary veins which are accompanied with a nerue. If this gristle (saith *Platerus* and *Bauhine* consenteth with him) bee too much pressed or curued inward in children, which disease women call the *Compression of the Heart*, it offendeth the Liuer and the stomacke vnder it, and those children die of that kinde of consumption which we call an *Atrophie*, for in children this gristle is somwhat long, and oftentimes may be felt with the finger. Heere also we must obserue that cauitie which the Ancients called κοιλία, commonly the *Heart-spoone*. The whole brest in men is somwhat elenated or raised vp, but in women it is more flat & depressed because they haue greater dugs which would stand out too far if the breastbone were raised as high as it is in men.

The vse of the brest-bone is the same which we shall say anon the vse of the ribs is. The Brest-blade is a defence to the parts thereunder, that is, the Midriffe & the mouth of the Stomacke; and this may be proued, saith *Bauhine*, because if it be compressed or rubbed too much, a *Nausea* or loathing will follow: againe, he that is readie to vomit shall find a paine iust vnder it. And thus much of the Brest-bone.

CHAP. XXVI. *Of the Ribbes.*

THE sides of the Chest are called by the Grecians πλευραὶ and ἐπάλξεις, because they are placed side by side like the Rowers in a Galley: the Latines call them *Costæ*, wee call them the Ribbes. They are commonly both in Men and in women on each side twelue, oftner more then fewer. For nature would rather there should be aboundance then want. And in a publicke Anatomy when a Malefactor was cut vp, *Bauhine* found thirteene on each side: the first on the left side was perfect, but the first on the right side was imperfect. The Names and Number.

Fallopius also twice found one too many, *Columbus* once eleauen at *Padua*. They are diuided into *True* and *Bastard* Ribs. The true Ribs are the seauen vppermost [table 18. fig. 9. from Char. 1 to 8] so called, because they make a perfect circle being ioyned together by the Spondels of the Backe and the Breast-bone. For behinde they are fastened with strong Ligaments by *Dearticulation* or *Diarthrosis* to the Spondels of the backe. [ta. 18. fig. 10, S T] And that they might sticke the closer the knotte is double, one higher at the body of the Spondell, another lower at his lateral all processes: Before, they are articulated to the brest-bone, [Tab. 18: fig. 9 ee] for their Cartilages bee like little heads ioyning with the smooth bosomes of the *sternon* by *Synarthrosis* or coarticulation. The two first Ribbes are called ἀντίστροφοι, as it were *Retorted*, the two next are called σύμφωνοι, that is, *solid*; the three last, by *Pollux* hee that gaue them all Names, ἐπιτρίτοι, that is, Pectorall Ribbes. The true ribs.

The Bastard Ribs are the fiue lower; they are soft and almost gristly, that themselues might be more safe from iniuries, and by them the parts thereunder. And indeed, the prominent parts of Bones were for the most part by Nature made gristles which if it be wounded or violated will not breake but easily reunite. These Bastarde ribs therefore do end into exquisite gristles, which are retorted vpward and fastned one to another [Tab 18. fig. 19 FE] excepting the twelfth, and so are ioyned to the gristles of the true ribbes. [tab. 18. fig. 19, l] The bastard ribs.

They may also be sayde to be imperfect, because they are onely articulated vnto the Rackebones, but that after diuers manners. For the eight and the ninth haue a double articulation, yet doe their ioynts not sticke out so farre as the ioyntes of the true Ribbes doe, which receiue more strength from the Racke-bones then from the Breast-bone. The eleauenth and the twelfth haue onely the vpper articulation; as also hath the first oftententimes, but the tenth is ioyned sometimes with a double ioynt, sometimes with a single.

These Bastard ribs do not attain vnto the Brest-bone that the lower belly might better be dilated when the stomacke is well stuffed or the womb impregnated. The eleuenth sometime, sometime also the twelfth are fastned to the Midriffe. Againe, the twelfth is the least of them all, and according to some mens estimation doth not deserue the name of a rib, that there might be roome left for the bowels in the lower belly, and because it was so little *Galen* calleth the eleuenth Rib the last. Sometime this twelfth Rib groweth to the oblique muscle of the *Abdomen*, sometime againe it is seen to haue a circumscription of a proper muscle whereby it is drawne downward.

All these ribs are not only of a bony yet fungous substance, [Table 18. fig. 11 R] but

alſo euery one hath his owne Griſtles, both behinde where they are articulated vnto the Rack-bones, and before where they are committed to the breſt-bone, [tab. 18. figu. 9 ᴬᴬ ſhew the coniunction of the ribs with the griſtles, C D. the coniunction of the Griſtles with the breſt-bone] But the fore-griſtles are greater and thicker, becauſe the fore-part of the cheſt is diſtended and contracted; ſo likewiſe the griſtles of the baſtard ribbes are longer then thoſe of the true ribs, but the griſtles of the true ribs are harder then thoſe of the baſtard ribs, becauſe they were to bee ioyned with the breaſt-bone which is a harder ſubſtance, whereas the griſtles of the baſtard ribs are thin and narrow, becauſe they are ioyned with other Griſtles: & hence it is that ſome Anatomiſts haue called them χόνδρους, that is Griſtles. Notwithſtanding the Griſtles of the firſt and laſt ribs are very ſhort, but that of the laſt is narrow and ſharpe, that of the firſt broad and large. The lower ribbes in men remaine griſtly euen to extreame old age: the vpper ſomewhat before that time do begin to grow bony, and haue, as we may ſay ſafely by *Galens* warrant, bony griſtles. In Virgins after their paps begin to ſwell the griſtles alſo grow ſome-what bony, the better to ſuſtaine the waight of the paps that lye vpon them, whereby if the ribs ſhould bee depreſſed, the motions of the Cheſt would be interrupted.

Their Figure

The figure of the ribs is ſemicircular like a Bow, to make the figure of the cheſt circular and round, whereby it becommeth ſtronger and more capacious. The length of the ribs is not the ſame in all, for the vpper and the lower are the ſhorteſt, the middlemoſt are the longeſt and the broadeſt, excepting the firſt which is the broadeſt and ſhorteſt of all the reſt. Againe, the vpper ribs are more crooked and more bent, the lower are not ſo embowed. All of them in their originall are narrow and ſomewhat round, & by how much they come neerer to the breſt by ſo much do they grow the broader, which broder part is called πλάτη or the Palme, the narrow part which is towardes the ſpine νῶτον, the Rower.

They are alſo thicker aboue then below, and by that ſigne may the right bee diſtinguiſhed from the left. On the outſide eſpecially where they are tyed to the rackebones they are rough [tab. 11. figu. 1 P] and vnequall, that from thence the Ligaments might proceede by which they are faſtned to the Rackes; in that place alſo they haue two protuberations, one whereby [ta. 18. figu. 11 ᵏ] they are articulated to the ſinus or boſome of the Rack-bone, another where they are ioyned to the tranſuerſe proceſſe. [Tab. 18. fig. 11 ᴹ] They are alſo exaſperated [Tab. 11. fig. 11 ᴿ] to receiue that Muſcle of the Cheſt which is called *Sacrolumbus*, accounted by *Veſalius* and *Falopius* for the fourth, by *Columbus* the fift Muſcle of the cheſt, as alſo for the originals and inſertions of the intercoſtal muſcles. On the inſides they are ſmoothe, that they might not hurt the *Pleura*, and in the lower part of euery rib, [tab. 18. fig. 11 ᴺ] there runneth a ſinus like a canale thoroughout theyr length to receiue three Veſſels, a Veine, an Artery & a Nerue, but the Nerue lyeth next vnto the rib; and theſe ſinus are moſt conſpicuous in the middle of the Ribs, and in that part that is next to the Rack-bones.

Their Vſe.

The vſe of the ribs is to be a defence vnto the breſt, that is, to defend the bowelles therein contained. Moreouer, to yeelde a fit place for the implantation and ſupportation of the Muſcles which ſerue for Reſpiration, that they ſhould not fall down and interrupt the functions of the Heart and the Lungs. Wherefore, that when we breath in & breath out though we be faſt aſleepe, the cheſt might more eaſily follow his neceſſary conſtriction and dilatation, a part of them was made griſtly, which griſtles likewiſe defend the bowels ſeated vnder them, and ſuſtaine ſome Muſcles of the *Abdomen* which otherwiſe would fall inward and impeach the offices of the bowels of the lower belly. And thus much of the Ribs.

CHAP. XXVII. *Of the Shoulder-blades.*

His Names.

THE backpart of the cheſt is called the Shoulder-blade, in Latine *Os Scapulæ*, in Greeke ὠμοπλάτη. [tab. 19. fig. 7, 8, 9] There are two of them, one on each ſide, which behinde ſitteth vpon the top of the Ribbes like a ſhield for their defence, and is articulated with the clauicle and with the arme; for whoſe ſake it was eſpecially created, as well to hold it to the body, as to affoord an originall to many Muſcles by which it is moued. It is faſtned alſo to the ribs, to the nowle and to the bone *Hyois* by the interpoſition or mediation of Muſcles.

The figure of it is after a ſort triangular: on the inſide [ta. 9. fig. 7 ᴹ] concauous: on the outſide

outside: [ta. 19. figu. 8 V, V] it is prominent, which place is called the Basis, and this basis hath an angle [ta. 19. fig. 7, 8, 9 shew the vpper Angle] and a rib both aboue and belowe; from which is produced a spine that looketh vpward. [Ta. 19. fig. 8 and 9 G H]

Table 19. *Is the same with Table* 16. *a little before in folio* 978.

The extremity of this Spine is commonly called ἀκρώμιον, albeit according to *Hippocrates* *Acromion* be the articulation of the clauicle with the vpper part of the blade or a gristlye bone, which like a Ligament tyeth those Bones together.

It hath three processes: the first is the shortest, and hath a short necke which is called *Scapulæ ceruix*, [t. 19. fig. 7, 8 C D] which Necke endeth into a sinnewated or hollowe *Cup* or head, [ta. 19. fig. 7 & 8 [A B]] which *Cup* receiueth the head of the arme, & it is compassed with a thicke gristle [t. 19. fig. 8 α [K]] whereby the *cup* is inlarged, that the heade of the arme should not so easily fall out of ioynt. The second processe is the ende of the spine, of which wee spake euen nowe, which hangeth ouer the ioynt of the arme, called therefore *Acromion*, [t. 19. fig. 7, 8, 9 [K]] the point of the shoulder and the top of the shoulder, and by this processe the shoulder-blade is ioyned with the clauicle. The third processe is the least, and on the inside [ta. 19. fig. 7 & 8, [E]] which is called σιγμοειδὴς, and from the likenesse it hath with an Anchor ἀγκυροειδὴς. Some call it *Coracoides*, because it is like the Beake of a Crow, and this processe holdeth the bone of the arme in his seat. Processes 3.

It hath fiue Appendices, three are at the inside and at the basis, and affoorde an originall to some Muscles: [ta. 19. fig. 7, 8, 9 [X Y]] the other two do breed Ligaments which ioyn the arme to the head of the blade, and the clauicle to his second processe which wee called *Acromion*. Appendices 5

It hath also two cauities, one aboue the Spine, and another belowe it, called *Interscapilum*.

Finally, there is an inequality in this Bone; for in the middest it is very thinne, in the processes thicke, medullous and fungous. It hath also perforations which admit Veines and Arteries for his nourishment. And thus much of the shoulder-blades. Cauities 2.

CHAP. XXVIII. *Of the Hip, Haunch and Share bones.*

THe third part of the Trunke was saide to be the Bone without a name, so called first by *Oribatius*, some from the greater part called it the Hanch-bone: *Rusius ἰσχίον, os Coxæ.* [t. 20. f. 12, 13, & 14] It appeareth to be one on each side, because the gristles are dryed vp, but in children till the seauenth yeare of theyr age it is found to be made of three Bones diuided by gristles, and therefore they are saide commonly to be on each side three bones.

The vpper and broader parts which are ioyned with the Holy-bone [tab. 20. fig. 13, [A B cc DD]] are called *ossa λαγόνων*, in Latine *Ilium*, in English the *Hanch-bone* [ta. 16. fig. 1 [mm] ta. 20. fi. 13 aboue [T] to [f]] Their semicircular circumference is called the Spine of the hanch-bone, [ta. 16. fig. 1 & 2. [ii] ta. 20. fig. 13 [HLMN]] which is vnequall, that some muscles might take their original therfrom, to wit, the oblique ascendent of the *Abdomen*, the fift of the chest, the first bender of the Leg, and the first extender called *Membranosus*. The inner part of the circumference is called *Costa* or the rib: the vtter part of the whole bone [Ta. 20. f. 14 at X] is called *Dorsum Illij* the backe of the Haunch-bone, wherein there are vnequal inscriptions or lines for the three muscles of the Thigh which make the Buttockes. The Hanch-bone,

The interiour part is hollow and broad to affoord a fit and conuenient position to the internall Iliacke Muscles: [ta. 20. fig. 13, KK] aboue also it extuberateth for the Square muscle of the backe that is the first, and below for the tenth of the thigh.

The lower and vtter parts of this bone are called *ossa Coxendicis*, [ta. 16. fig. 1 [nn] Tab. 20. fig. 13, below [T] & [f] as farre as to [RP]] in which there is a great sinus which they cal *Acetabulum* and *Pixidem* [ta. 20. fig. 12 and 14 [abc]] the *Cup*, and properly in our English Tongue the *Hip*, to which the head of the thigh is articulated exceeding strongly. This *cup* or Hip hath a gristly processe, [ta. 20. fig. 12 and 14 [c]] called *Supercilium* or the brow, in vvhose circumference there are obserued three bosomes, two protuberations, [ta. 20. figu. 12 and and 13, T, V] an acute processe, [ta. 20. fig. 13 & 14, [g]] and finally an Appendix [ta. 20. fi. 13 and 14 [i]] that is very thicke: all these were ordained for the production partly of Ligaments, partly of muscles.

Finally, the foure parts of this vnnamed Bone are called *ossa ὀνῆσις, Pubis*, in English the Share-bones, [ta. 16. fig. 1 and 2, [PP]. Ta. 20. fig. 13 and 14, that which is below R and Φ] The share-bones.

From T to *f in* Fig. 13, & 14, A part of the *Coxendix* called *Os Ilium* the *haunch*-bone, that which is below as far as to R & φ is called by the name of *Coxēdix* the Hip the remainder is the *sharebone*.

A B C C D D 13, the foreside of the hanch bone where it is ioyned to the Holy-bone distinguished by a protuberation CC into two *sinus* A B D D.

E F G 13, the backside of the hanchbone which gapeth from the Holy bone, & is filled vp by a gristle,

H 13,14, a part of the backside reaching out beyonde the processe of the Holy-bone.

K 13, An impression in the inside of the hanch-bone made for the originall of of the fist muscle of the back.

L 12,13, the inside of the *appendix* of the *hanch bone*.

M 12, the *anterior* end of the *appendix*.

N 13,14, his *posterior* end.

O 12,14, the outside of this *appendix*.

P Q R 13. A swelling from whence the tenth muscle of the thigh issueth.

* 13, this place affoordeth an originall to the 7. muscle of the thigh

S 12,13,14, the vpper *sinus* of the *Coxendix* aboue which do run the sixt muscle of the thigh, & the 7. with a Nerue,

T 12,13,14, A higher protuberation aboue this *sinus* or cauity.

V 12,13,14, another lower protuberation.

X Y Y 14, a darke line in the backe of the haunch bone X, another in the same place Y Y.

Y 12,13, the vpper *sinus* of the sharebone

a b 12,13, The *Cup* of the *Coxendix* which admitteth the head of the Thigh, the deepe hollownesse of it is marked with *c*. *d* 14, the *sinus* or bosome wherein the *Cup* is grauen. *e* 12,14, the brow of the *Cup*. *f* 13,14, a cauity of the *Coxendix* made for transmission of the fourth nerue of the Leg. *g* 13,14, the acute processe of the *Coxendix*. *h* 12,13,14, a *sinus* to which the tenth muscle of the thigh is reflected. *i* 12,14 the Appendix of the *Coxendix*, *k l m n* 14, diuers impressions in this appendix. *o* 14, the *posterior* end of this Appendix. *p* 12, P 14, the roughnesse of the share-bone to which the gristle groweth. *q* 12,13,14, the hole of the share-bone. *f* 12,13,14, a bosom aboue the hole of the sharebone. *t* 12,13,24, the lower processe of the sharebone.

Figure 12. sheweth the forepart of the Coxendix which is ioyned to the right side of the Holy-bone.

Fig. 13. the inside of the Coxendix. Fig. 14. his outside.

Fig. 15. the gristle that goeth betwixt the share-bone in a man

Fig. 16. the gristle that goeth betwixt them in a woman.

TABVLA XX.

because in the middle of the share they are ioyned together by a gristle. [t. 20. fig. 15. at 6] Before and aboue they haue a *sinus* or bosom, [ta. 20. fig. 12. x] made for the descent of the crurall vessell: they are also rough for the originall of the right and pyramidall muscles of the *Abdomen*, and of the second bender of the Leg. But otherwise they are but thinne bones and perforated with the greatest hole that is in the whole body [ta. 16. fig. 1, and 2, qq tab. 20, fig, 12, 13, and 14, q] This hole was made for lightnesse, and the empty place is stopped vp on the outside with the external *obturator* or compassing muscle of the thigh and on the inside with the internall, vnder the hole it hath a processe [ta, 20, fig, 13, 14, r] from whence the bodies of the yard and some muscles take their originall.

Their vse. These Bones ioyned with the Holy-bone doe make that cauity which they call the *Bason* [tab, 16. fig, 1, sheweth it] which contayneth a part of the Guts, the Bladder and the Wombe: and to conclude, these three bones put together make the *basis* or foundation of the body, which it selfe is immouable whilest all the body moueth vpon it. And thus much of the Trunke.

CHAP.

CHAP. XXIX. *Of the Bones of the Arme and the Cubit.*

WE haue gone through the two first parts of the *Sceleton*, that is, the Head and the Trunke; the third remayneth which comprehendeth the Ioynts. These Ioynts are two, the Hands and the Feete. The Hand we call all that which is betwixt the shoulder-blade and the Fingers; and is deuided into three parts, the Arme, the Cubit & the Hand properly so called, of which we will speake in their order, and then descend vnto the Foote.

The Arme is called by the Greekes βραχίων, by *Celsus Humerus*, commonly *brachium*. The names of the arme. It is but one bone [tab.21.fig.1,& 2,] round and vnequall, long also and the greatest of all the bones of the hand, yea of the whole body except the Thigh-bone if we beleeue *Galen*. But *Columbus* sayth that it is not so bigge as the Holy-bone, nor so broade as the Hanch-bone, nor longer then the Leg-bone. It is articulated to the shoulder-blade and the cubit, and for these articulations both the endes of it are protuberated or swell into heades. One bone. For in the vpper part where it is inserted into the *Cup* of the Blade, and articulated by that kinde of *dearticulation* which we called *inarticulation* it hath an Appendixe [table.21, figu, 1.[A B F H]] which maketh the head of the Arme or the *Acromion* seated in the vpper but inner parts.

This head is large and orbicular, and crusted ouer with a gristle [ta.21, fig,1,& 2,[A B C]] that it might better bee turned in all motions within the cauity of the *Cup* of blade, which also is enlarged for that purpose with a plentifull gristle. At the outside of this head do bunch out two processes rough and vnequall, whereout doe arise the strong Ligaments which tye the Arme to the blade. The first of these is seated on the foreside [fig.1,[D]] the other and the greater on the backeside [figu,1,& 2,[E]] and the greatest part of them both is contayned in the Appendix.

It hath two *Sinus* or bosomes, one orbicular and rough at the side of the head which it distinguisheth from the processes [tab.21.figu.1,[F G]] to which a Ligament is implanted. 2. Sinus, The other is on the outside and long, running downward [fi,1,H I] betwixt the two processes which it doeth distinguish or separate. And this *sinus* was grauen for the beginning of the bending muscle of the cubit which is called *Biceps*, and groweth out of the *cup* of the shoulder-blade, for through this *sinus* as through a pulley that muscle doth runne.

The lower part of the Arme which at the Cubit is articulated to the Ell & the Wand, is in Infants increased by an Appendix, which in processe of time is so vnited to the bones that there remayneth no footstep, no remembrance of the appendix. This lower part is broad and the figure of it diuers, for it is partly protuberated and partly excauated or hollowed.

The protuberations or processes are two very notable on each hand, and one at the sides of the orbe, because it was to be articulated to tvvo bones. The exterior of these [ta. 21, fig,1,[P]] is the thicker, and endeth into a head crusted ouer vvith a gristle vvhich entereth into the vpper *sinus* or cauity of the Wand. It is situate before, and is made round to turne the Wand vpvvard and dovvnard. This processe at the outside buncheth out very farre, that from thence some muscles might take their originall [fig.1.vnder Q] and endeth into an vnequall Line. Betwixt the heade and the protuberation there is a *sinus* on the backeside [fig.2.[R]] grauen, to conuay the fourth nerue that passeth vnto the hand. The processes.

The inner processe [[S]] which may easily be felt euen in liuing bodies, & swelleth much inward to yeilde a place for the originall of some muscles, is likewise crusted ouer with a gristle. Neare the side of the orbe it hath two *sinus* or cauities, one shallow in the foreside [figu 1.[T]] to leade along the third nerue that passeth vnto the Hand; the other in the backeside [fig.2.[V]] through which the fift nerue is conuayed. Betwixt these two *sinus* wee meet with an orb, which sayth *Falopius* may by a curious Anatomist bee called a third apdix. *Archangelus* calleth it a third and middle processe.

It is also called *trochlea* or the pulley whereto the Ell is articulated by *gynglimos*, and it is moued onely with a right motion: this orbe because it hath a cauity in the middest [[K]] and buncheth out on either side [[LM]] seemeth to be like the gutture of a pulley wherein the cord doeth slip, and therefore it is commonly called *Humeri rotula* the gutture of the Arme. [[KLM]] That part of this cauity which is like a pulley was at the first an Appendix, yea betwixt the two processes there went a gristle which after the seuenth yeare groweth bony, and maketh a part of the cauity and the outward browe thereof. In the vpper part

Tab.21.sheweth the Bones of the arme and the Cubit.
Fig.1.sheweth the foreside of the right arme.
Fig.2. The backside.
Fig.3 & 4. Shew the inner & outward parts of the left cubit
Fig.5 & 6. Shew the inner and outer parts of the left Ell.
Fig.7 & 8. The inner and vtter seate of the left wand
Fig.9. The lower part of the left wand.
Fig.10 & 11. The lower and vpper part of the right wand.
Fig.12 & 13. The vpper & lower extremity of the right El.

TABVLA XXI.

A,B,C,1,2. The head of the arme which entreth into the cauity of the shoulderblade
D 1, His anterior processe.
E 1,2. The other posterior processe.
F G, 1,2. the orbicular cauity of the head thereof.
H,I,1. A right sinus leading directly downeward.
K 1,2, the sinus of the gutture of the arme which receiueth the cubit.
L,M,1,2, the two lips of the gutture, the inner and the vtter.
N,I, 1,2, the anterior sinus in the vpper part of the guttur.
O 2, Another posterior sinus.
P,1,2, the head of the arm to which the wand is articulated.
Q 1,2, A line swelling out in the vtter side of the arme.
R 2. A bosome of the vtter proces of the arme
S 1,2. the inner protuberation of the Arme.
T 1, the anterior sinus of the inner protuberation.
V,6. the posterior sinus of the same,
X,Z 2 the length of the arme betwixt his thick ends.
Y 1, the middle part, where the bone of the arme is as it were writhen.
a 1, A bunching line in the fore-side, which runneth along as farre as to *f*.
b,*c*,1. Impressions on both sides the line.
d 1, the vpper gibbous part of the Arme.
e,1,2 A roughnesse in the outside of the middle of the arme.
f 1. Another somewhat higher, but more inward.

Fig. 3,4,5,6,7,8,9,10,11,12,13.

A 3,4. The vpper part of the Cubit, whereby it is ioyned to the arme.
B,3,4. The lower part of the cubite reaching to the wrest.
C 3,5,13, the anterior and vpper processe of the Ell.
D,3,4,5,13. the posterior and vpper processe of the Ell.
E,3,4,5. A sinus of the Ell, receiuing the *pulley* of the arme.
F,13, A protuberation in the foresaide sinus.
GG,HH,13. The internal side depressed nere vnto the protuberation at G. the external side at H.
I,13, A sharpe small cauity in the left hand, to which the right aunsweres on the other side. L,3,5,13, An saperity in the roote of the processe of the Ell. M,3,4,7,8,11, the Necke of the Wand. O 11, A sinus of the wand wherein the head of the arme doth enter. P 3,4,5,6,12, the necke of the Ell. Q,3,4 5,6,12, the appendix of the Ell. R,3,4,5,6,12 the processe of the Ell called *Styloides*. S 12, A sinus or cauity in the basis of the appendix of the Ell. T 3,4,7,8,9,10, a Gristle growing to this sinus. V 4,6, a sinus in the side of the appendix of the Ell. *X*,*Y*,*Z*,4,6 three corners of the latter processe of the Ell. *aa* 3,4. a line or the first bunching part of the Ell. *bb* 3,5, the second line of the Ell. * An oblique inferiour line of the Ell. *cc*, 3 4,5. the sharpnesse of the Ell touching the wand. *dd* 3,6 the first vtter side of the Ell. *e* 4,6, the 2 vtter side. *f* 3 5, the lower rough side. *gg* 4,6 a line drawn in the vtter side *h*,*i* 1,3, the commissure of the wand with the ell aboue *h* and below *i*. *i*.*k*.3 A distance where these bones do part asunder. *l*, 13, A sinus of the ell wherein the head of the Wand is turned. *m*,7,8,11 the head of the wand, resting vpon the *sinus* of the *Ell l*. *n*,3,7, the lower appendix of the wande. *o* 9, A Sinus of the *Radius* receiuing the head of the *Ell*. *p*,5,12, the head of the *Ell* entering into the Sinus of the wand *o*. *qq*, 3,4,7,8 11. A roughnesse swelling vnder the necke of the wand. *rr*, 3,4,7,8. An acute line respecting the *Ell* & the wand. *ſ*,*ſ* 3,7, the rough internall side of the Wand. *tt*, 4,8 the smooth externall side of the wand. *u*,4,7, 8, A roughnesse in the midst of the length of the wand. *xy* 3,10, a Sinus of the wand whereunto the wrest is ioyned. *z* 3,10, a protuberation in the midst of the Sinus. *α* 3,7,8,9,10, the processe of the Sinus x. *ββ*, 4,8, the inner Sinus of the wand double which earieth the tendons. *ε* 4,8, the externall double Sinus of the Wand. *η* 4,8, the 4th Sinus producing a Ligament. *θ* 4, A Sinus of the wand common with the *Ell*.

of the Orbe there are grauen two cauities or boſomes, which *Hippocrates* called βαβυλῶνες, diſtinguiſhed onely by a ſcale: one of theſe is in the forepart, [fig.1 N] the other which is the larger and the deeper [fig.2 O] is in the backpart, and theſe two are the limites of the motion of the Ell. Moreouer this bone throughout his length is rounde in the middeſt, [fig.1 b] in the ſides a little compreſſed, [fig: 1 ac] behinde yet more depreſſed, wherein there is a ſhallow gutture [fig: 2 Y] whereunto the fourth Nerue of the arme creepeth; before, there is a double aſperity or roughneſſe, one [fig: 12 e] made for the ſtronger implantation of the muſcles that mooue the arme, and for the originall of the muſcle which is called *Brachiæus*. In old men the roughneſſe is ſo great that from thence there ſeemeth a proceſſe to grow, whereunto the muſcle called *Deltois* is inſerted. The other *Aſperitie*, [figure. 1, f] is that whereto the fleſhy part of the Double-headed Muſcle dooth grow.

It hath alſo ſmall perforations nere the browes of the head and the boſomes, through which ſome Ligaments are produced or implanted; and moreouer ſome other perforations it hath on the inſide of the length of the bones which admit certaine veines. Finally, the bone of the arme is on the inſide hollowed with a deepe boſome or cauitie, as wel to containe the Marrowe which is his Nouriſhment, as alſo to make the Bone the lighter. Perforations.

The ſecond part of the hand in the large acceptation is called the Cubit, and is ſeated betwixt the Arme and the wreſt, with both which it is articulated. It conſiſteth of two bones lying one vpon another, and faſtened together with a Membranous Ligament. Theſe bones are long, but yet ſhorter then the bone of the arme, and they haue appendices at either ends. The Cubite.

The lower of theſe [fig.3,4 A B 5,6] which is alſo the greater, hath for the moſt part the name of the whole and is called *Cubitus*, yet to put a difference it is alſo called *Vlna* the *Ell*, and ſometime *focile maius*, and is articulated to the ſinus [Figu.2 K LM] which is in the guttur of the arme by *Ginglymos*, and by this articulation both flexion and extention is made. The Ell.

It hath in the vpper part two notable proceſſes, long and as it were triangular, but the angles are obtuſe or dull, and theſe proceſſes together with the cauity in the midſt, which is called *Sigmoides*, are in yong infants griſtly, yet the anterior proceſſe, together with the cauity do quickly become bones, and the marke of the appendix is obliterated. The Poſterior proceſſe beginneth not to harden till after the ſeuenth yeare, and then it is agglutinated or faſtened to the reſt of the bone. His proceſſes.

The Anterior and vpper of theſe [fig.3,5,13 C] entreth into the Sinus or cauity of the Arme, [Fig.1 N] and is cruſted ouer with a griſtle on the inſide: the poſterior [D] is the thicker and the larger, which *Hippocrates* calleth ἀγκῶνα, *Galen* ὠλέκρανον, the Latines call it *Gibberum*, and we the *Elbow*; it entereth into the poſterior cauity of the arme. [figur. 2 O] The places of both theſe proceſſes are rough, [Fig. 13, C D] partly that the Ligaments might more ſtrongly encompaſſe the ioynt, partly for the inſertion of ſome muſcles of the cubit partly alſo to giue originall vnto the muſcles that bend the Fingers; for which cauſe alſo the bone is rough at the roote of the proceſſe: [Figu.5 and 13 L] the circumference alſo of the Sinus or cauity is rough [Fig.13 I K] that from thence Ligaments might yſſue, for in the middle of theſe proceſſes there is a great Sinus [Fig.3,5 Z betwixte C D] which receyueth the gutture of the arme. This ſinus is hollowed like a ſemi-circle, and being concluded or cloſed vp by theſe ſwelling proceſſes, repreſenteth the forme of the Greeke *Sigma C.* and therefore by *Galen* is called σιγμοειδὴς, and is cruſted alſo ouer with a Griſtle. But becauſe it might be fitted exactly to the gutture of the arme, it hath in the middeſt an obtuſe protuberation, [Fig.13 betweene FF] and at the ſides on either hande is compreſſed, [fig.13 GG, HH] ſo that it may be compared to a cord compaſsing the gutter or rim of a wheele, that in it the cubit may be bent and extended: and from it is ſeparated by a ſwelling line, leaſt the Ell ſhould ſlippe this way or that way: hence comes the mutuall ingreſſe of the bones one into another, which kinde of articulation is called *Ginglymos*, which we know not how better to expreſſe, then as the crookes of a paire of Hinges do receiue and are receyued one of another. There is yet another Sinus at his outſide ſmooth and cruſted ouer with a griſtle, [fig.5, and 13, I] which receyueth the heade of the *Radius* or Wand. [fig.7,11 m] The Elbow.

From hence the Ell deſcending growes ſlenderer by degrees, [fig:3, from A to B] and at the

the wreſt is encreaſed with a ſmall necke. [fig. 3,4,5,6,12 *] It hath alſo a round Appendix or an obtuſe head inclining inward, [fig.3,4,5,6,12 ◦] about which the Wande is led vpward and downward. Finally it determineth into an acute proceſſe, [R in the ſame figures] which is called *Styloides*, becauſe it is like a probe or writing pen which the Ancients were wont to vſe, not much vnlike a long Bodkin; and from this Bodkin there groweth a Ligament which firmeth or faſteneth the ioynt of the wreſt with the Ell. At the baſis alſo of this appendix there is grauen another vnequall ſinus [Figu.12 S] which diſtinguiſheth the Appendix of the Ell from the wreſt, and to it there is adioyned a griſtle which is placed betwixt this articulation; [fig.3,4,7,8,9,10 τ] another ſinus ſomwhat long is grauen on the outſide betwixt the two protuberations, fig.4,6,12 V] to guide & direct the tendon of the firſt muſcle that extendeth the wreſt. [T]

The Formeof the Bone. Furthermore, the Ell on the lower ſide vpon which it reſteth when we lean, is gibbous a good way, [Fig.6. X Y Z] and beſide there are foure ſwelling lines which run throughout his length made for the vſe of the muſcles of the wreſt. The firſt [fig.4 & 6 from zby *a* and fig.1 *aa*] The ſecond ariſeth or ſwelleth more toward the wreſt [fig.3, 5,6 *] for the originall of the Square muſcle. The third is the ſharpeſt and the rougheſt [fig.3,4,5 ◦◦] that from thence might ariſe a Ligament which like a membrane faſteneth together the Ell and the Wand. The fourth is prominent indeede but obtuſe or blunt, [fig.4 & 6 ββ] from which three muſcles haue their originall.

His vſe The vſe of the Ell is, that the Hand without danger might bee mooued outward, and againe with facility returne inward.

The other bone of the Cubit which is the vpper and the ſhorter, and occupyeth almoſt the whole exterior part of the cubit, fig.7 and 8] is called κερκὶς, by ſome *Focile minus*, in Latine *Radius*, in Engliſh the *Wand*. This bone in reſpect of the Ell is oblique, and is committed or ioyned thereto aboue and below, [fig.3 hi] ſo that aboue the Ell receyueth the wand, below the wand receyueth the Ell; but in the middeſt they ſtand off one from another a good diſtance, [fig.3 kk] partly that the wand might more readily be moued vpward and downward, partly that a place might be made for the muſcles which extend the Cubit.

The *Radius* or Wand.

This wand is articulated to the arme *per Diarthroſin*, by *Dearticulation*, hauing an oblique and ſlender necke; [fig.7,8,11 M] a round and depreſſed head, [fi.7,8,11 N] cruſted ouer with a griſtle for more agility of motion, but where it regardeth the arme it hath a round or ſuperficiary boſome [fig.11 O] into which the head of the arme entreth, [fig.1. P] and at this head the VVand when the Ell is at reſt is turned downward and vpward. A little aboue the necke it hath a rugged and abrupt proceſſe or protuberation [fig.3,4,7,8 11 q] into which is inſerted the tendon of the anterior muſcle that bendeth the Cubit: ſo alſo through his length there runneth an acute and bunching line [figu.3,4,7,8, rr] vnto which is faſtned a Ligament that ioyneth the Ell and the wand together, on eyther ſide with which line the bone is compreſſed [F.3,7, *ſ*, *ſ*. and fig.4,8 tt] to giue way to the Muſcles. The bone alſo it ſelfe throughout the middeſt of his length is rough, [figu.4,7,8, uu] ſo made for the inſertion of two muſcles of the wand. This wand below at the wreſt is dilated, and groweth thicker, becauſe of a boſome therein to be made for the articulation of the wreſt with the cubit.

His Appendances. It alſo hath an Appendix [fig.3,7 nn] with a double boſom cruſted ouer with a Griſtle, [fig.5,12 °] that therein the head [fig.5,12 P] of the appendix of the Ell which is alſo couered with a Criſtle might be mooued. This boſome or cauity was made double [fig.3, 10 xy] becauſe there are two bones of the wreſt articulated therewith, to wit, the firſt and the ſecond: [ta.22.fig.1,2,4.5, char.1,2] alſo where theſe two are ioyned together, the ſinus protuberateth moderately in the middeſt, [Fig.3,10 z] yet beſide that protuberation it hath alſo a proceſſe. [fig.3,7,9,10 α]

The Sinus. The outſide of the Appendixe of the wand, as alſo of the wreſt is gibbous, and therein hath foure ſinus inſculped or grauen, [fig.4 γ, δ, ε, ζ, η] thorough which the tendons of the muſcles might be more certainly conducted through the annular Ligaments. The fourth of theſe [η] is very ſhallow but rough, for it bringeth foorth a tranſuerſe Ligament and beſide ſwelleth vpward, for into that ſwelling the tendon of the Long muſcle which turneth the wand vpward is infixed.

There is alſo in the ſame place another ſinus common to the Ell and the wand [Fig. 4 θ] made for the Tendon of the muſcle that extendeth the little Finger. [ι]

Both

Both these bones of the Cubit are of a solide and hard substance excepting their Appendances, and full of smal holes bored also to containe marrow, but if you consider them apart they are one contrary to another in respect of their parts, for the vpper part of the Ell is the thicker the lower is the thinner, contrariwise the vppet part of the VVand is the thinner & the lower is the thicker. Finally, the vse of the wand is to moue the Hand downward and vpward, as also in compasse, although the Ell, saith *Archangelus*, be not moued. The consistence of the bones of the cubit.

CHAP. XXX. *Of the Bones of the Hand properly so called, that is, of the Wrest and After-wrest.*

THE Bones of the Hand doe follow in the next place which are of foure sortes: first those of the Wrest; secondly those of the Afterwrest; thirdly the bones of the Fingers; fourthly the Seede-bones called *Sesamina*.

The Wrest is called in Greeke καρπὸς, in Latine properly by *Celsus brachiale*, but the Greek word is also among the Latines grown into vse, which is *carpus*, wee call it the Wrest, which is that part of the Hand which is articulated to the Cubite and to the After-wrest, and is construed or made of eight bones; most Anatomistes say of seauen, but because the first is thought to bee double, therefore sayth *Archangelus* we account eight. The wrest.

These bones are distinguished in a double order, the reason was that the Hand might be moued with more agility. [ta.22.fig.3,char.5,6,] These eight bones do differ in their magnitude, forme, situation and consistence, and in the first generation are all gristles and not bones, but in processe of time they become hard and grow bony. Their substance is spongy as are all the rest of the bones which of gristles become bony, of which kinde are all Appendices, the bones of the breast and such like. These bones are not without marrow, and beside are couered ouer with gristly and strong Ligaments, whereby they are so compacted together, but the vpper more then the lower, that if you doe not deuide the Ligaments and the Membranes also, you will thinke that they are but one bone, which hath deceiued some Anatomists. 8. bones.

They haue a double *superficies*, the one *exterior* and gibbous [fig,4] the other *interior* and sinuated or concauous, [figu,3] and aboue, where they are ioyned to the Cubit, as also below where they are articulated with the After-wrest they are all smooth and crusted ouer with a gristle, but beside that gristle where they touch one another they haue also *sinus* or cauities and heades crusted with a slippery gristle: and this articulation of these bones is to be referred to that third kinde which *Galen* calleth *Neutrall* and doubtfull; for in respect of their composition it may be called *Dearticulation*, and in respect of their pure motion it may bee called *Coarticulation*. Foure of these ate reposed in the vpper ranke of the wrest which is next vnto the Cubit, [tab,22,figur,1,2,3,4,char.1,2,3,4] the other foure in the lower ranke. [chara,5,6,7,8] But because these bones want proper names, therefore they are distinguished onely by their order and number. their surface. Their articulation.

VVe call that the first which maketh the inside of the vpper ranke. It is a long bone curued inward and articulated to the VVand together with the second bone of the latter ranke, and his head entreth into a *sinus* of the second bone on the inside. Another head it hath also which is greater then the former and lower, and entreth before, into a *sinus* formed by the fift and sixt bones. It hath also a notable *sinus*, wherein together with the second bone it admitteth on the inside the head of the seauenth bone. The first bone of the wrest.

The second bone of the wrest leaneth vnto the former and is lesse then it: it is reposed behind in a *sinus* insculped in the appendix of the VVand, [tab,21,fig,3,10,xy] and is ioyned on the foreside with the first bone, below with the seauenth, behind with the third hauing a plaine *superficies*.

The third is ioyned with a plaine *superficies* also to the Ell and his gristle: [ta,21,figu,3,4,7,8,r] againe to the second and the fourth; and below it hath a large head which entreth into a *sinus* of the eight bone.

The fourth bone is called *Os rectum* the Right-bone, and is the hardest and the least of al the rest, and almost round, for it is neither hollowed nor protuberated as the rest are. It is ioyned with a depressed head to the externall side of the third bone, and seemeth also to be a little inserted into the processe of the eight bone; otherwise it toucheth no bone of that ranke, but in the vpper part thereof the Tendon of the muscle that bendeth the wrest is inserted: below, two muscles haue their originall which goe into the little Finger.

The

Table 22. Fig. 1. & 2. The first sheweth the inside of the bones of the Hand, the second the outside.

Figure. 3. & 4. shew the inside and outside of the bones of the wrest.

Fig. 5. The posterior part of the bones of the wrest articulated to the Cubit.

Fig. 6. their anterior part ioyned to the Afterwrest.

Fig. 7. Two bones making the first Ioynt of the Fingers.

Fig. 8. The second Ioynt.

Fig. 9. The third Ioynt.

Fig. 10. A Nayle parted from the Finger and shewed on both sides.

Fig. 11. The Seede-bones in the Foote & the Hand.

TABVLA XXII.

A 1,2, The first bone of the Afterwrest supporting the thumbe.

I,II,III,IIII, The foure other bones of the Afterwrest ioyned to the fingers.

B C 1,2, the two bones of the thumbe.

D E F 1,2, the three bones of the fore-finger, the same also in the rest of the Fingers.

G 3,6, The gutture of the fift bone of the wtest whereto the first bone of the Afterwrest is articulated.

a b 6, the length of this gutture

c d 6, The inside of the gutture *c*, the outside *d*.

e 3,4,6, A *sinus* at the gutture which the second bone of the Afterwrest doth touch

H 3,4,6, The *sinus* of the sixt bone of the wrest whereto the second bone of the Afterwrest is ioyned.

f 3,4,6, A part of this *sinus* which the third bone of the Afterwrest scarce toucheth.

I 3,4,6, the *sinus* of the seuenth bone of the wrest to which the third bone of the afterwrest is ioyned.

K 3,4,6, The place of the eight bone of the wrest which admitteth the fourth bone of the Afterwrest.

L 3,4,6, a *sinus* of the same bone receiuing the fift bone of the Afterwrest.

M 1,2, a small bone placed sometimes outwardly at the ioynt of the eight bone of the wrest.

N 1,3,6, a processe of the same eight bone swelling out into the ball of the hand.

O 1,3,6, the processe of the fift bone of the wrest from whence groweth a Ligament

P 2, an Appendix of the wrest wherby they are ioyned to the Afterwrest.

Q 2, Another Appendix which with the head entreth into the *sinus* of the fingers.

R 1,2, the distance betwixt the bones of the Afterwrest.

S 1,2, two Seed-bones set at the inside and outside of the first ioynt.

T 1,2, two Seed bones in the first ioynts of the foure fingers.

V V 1, one Seedebone in the second and 3. ioynts of the fingers.

Char. 1,2,3,4,5,6,7,8, these numbers in six figures doe shew the eight bones of the wrest.

Fig. 7,8,9.

A 7, the bone of the Afterwrest which supporteth the fore finger.

B 7, The first bone of Fore finger. C 7, the round head of the bone of the Afterwrest. D 7, a *sinus* of the Fore finger receiuing the foresaid head. E F 8, the first bone of the Fore finger E, the second F. G H 8 two small heads of the first bone of the Fore finger. I K 8, two *sinus* of the second bone of the Fore finger. L 8, a *sinus* betwixt the two small heads of the first bone. M 8, a small head betwixt the two *sinus* of the 2. bone. N 9, the second bone of the Forefinger and his 2 heads. O 9. the third bone of the Forefinger containing a *sinus*. *Fig.* 10. A 10, The inside of the nayle hollow. B 10, his soft roote which the skin is wont to couer. C 10, the outside of the nayle gibbous. *Fig.* 11. A 11, the lower side of the Seedbone that is placed before the first ioynt of the great Toe. B 11, the vpper part of the same which is next vnto the ioynt. C 11. the vpper of another Seed-bone. D 11, the lower part. *a a* 11, the Seed-bones at the ioynt of the thumbe. *b b* 11, the seede-bones at the ioynt of the Forefinger. *c c* 11. Seede-bones placed at the little finger.

The fift bone of the wreſt on the outſide toward the thumbe, receiueth into his vpper ſinus the poſterior head of the firſt bone on the inſide, it receyueth into another Sinus the head of the ſixt Bone. It hath alſo a lower Sinus [tab.22.fig.3,6 °] which is long[fig. 6 a b] grauen ſomewhat deepe on the inſide and the outſide, [figu. 6 c d] wherein it receyueth the head of the firſt bone of the thumbe, as alſo a part of the fifte bone of the Afterwreſt. [fig.3,4,6 c] It produceth alſo on his inſide a proceſſe [figu.1,3,6 O] to make waie for the Tendons of the Muſcles that bend the fingers, and ſo with the fourth bone maketh that paſſage hollow.

The ſixt Bone receiueth into his ſinus on the backſide the firſt bone, and his outwarde head entreth into the ſinus of the fift, his inner head alſo is ioyned with a plaine *ſuperficies* to the ſeauenth bone. This bone alſo receyueth the firſt bone of the Afterwreſt which ſupporteth the roote of the fore-finger, [figu.3,4,6 K] but the ſecond more obſcurely. [fi. 3,4,6 *f*.]

The ſeauenth, which is the greateſt of the ſecond ranke (as the ſixt is the leaſt) is eaſily luxed becauſe of his laxe connexion. It hath a round head which entreth into the ſinus which is common to the firſt and ſecond bone. It is alſo looſely articulated on the inſide to the ſixt bone, on the outſide with a depreſſed head to the eight bone, whereto it is likewiſe ioyned by the interpoſition of a griſtly Ligament. Finally, it is faſtned to the ſecond bone of the After-wreſt.

The eight bone which like a wedge is placed between the third and the ſeuenth bones is ioyned at the left ſide with a depreſſed head to the third bone. On the right ſide with a depreſſed Sinus to the ſeuenth: before, his ſuperficies is broad, [Fig.3,4,6 K] whereby it is ioyned to the third bone of the After-wreſt and receiueth in a certaine Sinus [Fig.3,4, 6 L] the Heade of the fourth bone of the After-wreſt. It alſo produceth in the inſide of the wreſt a proceſſe which inclineth from the outſide inwarde, exſculped or grauen like the letter C. to make the hand hollow to containe the tendons of the muſcles that bend the Fingers. Out of the toppe of this proceſſe groweth the tranſuerſe Ligament of the wreſt, and to it is faſtned a ſeed-bone. [Fig.1 & 2 M] And thus much of the wreſt.

The next part of the Hand is called in Greeke μεταχάρπιον, in Latine *Poſtbrachiale*, by ſome *Ima palma*, we will call it the After-wreſt. It is that part of the hande which is betwixt the wreſt and the rootes of the Fingers, and conſiſteth of foure bones, of fiue ſay ſome Anatomiſts, who reckon the firſt bone of the thumb with the Afterwreſt, becauſe we do not meete with it bare as the bones of the reſt of the Fingers are, but it lyes deeper as the other bones of the Afterwreſt. [ta.21.fig.1 & 2] The after-wreſt.

Theſe bones of the After-wreſt being placed betwixt the wreſt and the bones of the Fingers, [char.I.II.III.IV] are ioyned to the wreſt by *Coarticulation*; or rather by *doubtfull articulation* as they are ioyned to the bones of the Fingers by *dearticulation*; for al the bones of the After wreſt where they regard the Fingers do end into a rounde head, that ſo they might enter into the ſhallow or ſuperficiary cauities of the ſubſequent ioynts. Among themſelues they are ioyned onely by contaction of their extremities towardes the bones of the wreſt, where they are faſtned with griſtly Ligaments. [Fig.2 P] The bones of the afterwreſt

Theſe bones of the After wreſt are longer then the bones of the fingers, and the firſt of them which ſtandeth before the fore-finger is the longeſt and thickeſt of them, all the reſt are by degrees ſhorter and thinner; beſide they are all ſomewhat broader on the outſide then they are on the inſide.

Toward their extremities they growe thicke and haue Appendices growing to them aboue and below, [figu. 2 P ~] out of which Appendices yſſue Ligaments whereby theſe bones are ioyned together though that coniunction be ſomewhat diſſolute or looſe: for the vpper are faſtned to the bones of the wreſt, but the Appendices themſelues are tyed together by the interpoſition of a griſtlye Ligament. The lower appendices which are the greater are faſtned to the bones by coalition, for their head is round and long, forward and backward, lengthned out ſomewhat to the ſides, and cruſted ouer with a griſtle, and theſe heads do inſinuate themſelues into the Sinus of the firſt bones of the fingers.

Theſe bones are after a ſort round yet haue they as it were three ſides, two inward ſides ending into a line the better to giue way to the muſcles called *Interoſſei* or the *bone-bound* Muſcles, [fig. 1] and one externall which maketh the hand plaine. [fig.2]

There is alſo betwixt theſe Bones an intermediate diſtance, [figu. 1, 2 R] in which diſtance the *bone-bound* muſcles are placed, that is to ſay two in euery diſtance. And becauſe The diſtance betwixt them

the

the palme of the Hand ſhould not ſwell too great by the bellies of theſe muſcles and ſo be made leſſe fit for comprehenſion, as alſo that the place might be ſufficient to containe them, theſe bones on the inſide which is next vnto the palme are curued & their outſide is gibbous: they are alſo cornered and haue ſwelling lines in them made for the inſertion of the muſcles in that place.

Their proceſſes. The firſt bone alſo where it is articulated with the wreſt hath a proceſſe [ta,22.fig.15 aboue char.6,and 7,] whereinto the ſecond muſcle that bendeth the wreſt is inſerted. In like manner the fourth bone ſwelleth on the outſide [figu.1,aboue M] into which ſwelling the third muſcle of the wreſt is inſerted. Note alſo that the palme of the hand is eſpecially made hollow by the firſt bone of the thumb (which ſome make the firſt of the Afterwreſt) and by the fourth of the After-wreſt, for the other three doe helpe that cauity but little.

Vſe. Finally, the bones of the Afterwreſt are fiſtulated or hollow to contayne marrow. Their vſe is to eſtabliſh and ſtrengthen the Palme, that it might comprehend or containe whatſoeuer it is applyed vnto with more ſtedfaſtnes. And thus much of the VVreſt and Afterwreſt.

CHAP. XXXI *Of the Bones of the Fingers.*

THE Fingers which make the third part of the Hand are conſtrued or compounded of fifteene bones: for we ſay, ſayth *Bauhine*, that the thumbe alſo hath three bones. And becauſe they ſtand as it were in rank, therefore the Grecians haue called their order φαλάγγας, as it were the Files of a battell diſpoſed in order.

The row of the fingers, The particular bones doe want proper names, and therefore are expreſſed by the names of the fingers to which they appertaine, as the firſt bone of the thumbe or the fore finger; the ſecond and the third and ſo in the reſt. Their number was with wonderfull wiſedome ordayned as was fitteſt for the facility and variety of motion, for if they had beene more they could not haue beene perfectly and ſtrongly extended: againe, if they had beene fewer the fingers could not haue beene moued into ſo many formes. *Galen* in his firſt and ſecond bookes *de vſu partium*, hath ſo elegantly diſcourſed of the counſell and wiſedome of Nature in this poynt that it will not onely delight any man that ſhall reade it, but alſo tranſport him as he himſelfe ſeemeth to haue beene tranſported into an admiration of the wonderfull wiſedome of the Creator.

Their forme The forme of theſe bones on the outſide (excepting the laſt) is gibbous and crooked, on the inſide it is plaine and ſomewhat hollowed or ſadled, partly becauſe we apprehend with the inſide of the hand, partly becauſe more tendons run into the inſide then into the outſide. Furthermore on their inſide ther are certain lines rũning on both ſides the bones throughout their length, from which lines certaine Ligaments are produced, which like rings doe encompaſſe the Tendons and hold them ſtedfaſtly in their places. Theſe bones although they be hard and faſt or denſe that the hand might vſe them in manifould imployments without danger or annoyance, yet they haue a cauity or hollowneſſe within them which contayneth marrow.

Magnitude, Their magnitude is diuers, for the firſt bone of each finger is larger in all the dimenſions, that is, thicker, longer and broader then the ſecond, [ta,22,fig,1,a& 2,] in like manner the ſecond is greater thẽ the third; for Nature prouided that the thicker finger ſhold haue the thicker bones, and the longer finger the longer bones.. Notwithſtanding albeit their magnitude is not the ſame, yet they appeare all equall, & all the fingers are broght together into one right line when we would comprehend any round body. Moreouer they are in the beginning broader, and ſo grow narrower by degrees. At the ioynts all the bones are ſomewhat thicke, that the *baſis* being the larger the conſtruction might bee more ſubſtantiall: in their length they are not all of a thickneſſe leaſt their quantity or waight ſhould haue beene offenſiue. The ſwelling protuberations of the bones are called κόρυλοι *Knots*, but in Engliſh Knuckles.

The bones of the firſt and ſecond ioynt haue Appendices aboue and below made for the originall and inſertion of muſcles: the bones of the third ioynt haue Appendices onely aboue; for the very end or head of the finger being not articulated againe but onely ioyned with fleſh or a nayle, needed no Appendix at all: they are alſo cruſted ouer with griſtles that the ioynt might be at all times glib and eaſie to moue.

The

The first bone of the thumb [tab.22.fig.1 & 2 ^A] aboue, hath a long sinus, but before & behinde it buncheth out, that it might ioyne with the furrow or guttur of the fist bone of the wrest. It is manifestly mooued directly outward and inward toward the palm; sideward toward the forefinger, from which also it is remoued by reason of the length of the guttur, and beside it is turned circularly. But if the head of the bone of the wrest bee produced more backward then is the bone of the thumbe easily and directly bent backward, so haue I seene a man able to lay the Naile of his thumbe vpon his wrest. Some also will in like manner turne all their fingers vppon the backe of their hands. Aboue, this first bone of the thumbe hath a head but not perfectly round; which entreth into the sinus of the second bone. *The first bone of the thumb.*

The second Bone of the Thumbe where it regardeth the third is diuided by the Mediation of a long sinus [fig.8. L] into two long heads, [fig.8 ^{G H}] protuberating before on either side. *The second.*

The third bone hath two Sinus [fig.8, ^{I K}] distinguished by a long knot, [^M] whereinto the heads of the second bone are receyued: againe the knub of the third bone entreth into the Sinus of the second so the second is receiued of the third, and the second receyueth the third, making thereby a *Ginglymos*, wherein the two Bones are so straightned, that onely the third bone can be bended or extended. *The third.*

After the same manner are the articulations made of the rest of the fingers, for they haue two heads and two bosomes. But the first ioynts of the foure fingers haue but one head and one bosome, because the bones of the After-wrest haue each but one Heade, which looketh especially into the inside of the Hande, and hath more aboundance of gristly substance about it. The Sinus in the first bone of the foure fingers is orbicular, and aboue that head the first bone is bent, extended and moued to the sides. The third bone also it selfe swelleth into a gristly top and rough head [fig.9 O] whereinto is inserted the Tendon that bendeth it. Moreouer, all the inside is rough and vnequall, and at the end it is not knotted as the first and second bones are, but lyeth plaine to giue waie vnto the Nayles. *The Bones of the Fingers.*

CHAP. XXXIII. *Of the Seede-bones.*

THE last thing to bee considered in the Hande are the Seede-bones, called σησαμοειδῆ [tab.22.fig.9] because they are like *Sesamum* seede. These Bones are placed in the ioyntes or knuckles of the fingers and of the toes: for the most part they grow vnto the Tendons and lurke vnder them; and therfore he that would make demonstration of them must seeke for them in the dissection of the Tendons of the Muscles which are seated about these bones. Moreouer, they are so entangled with ligaments, that if you desire to clense the bones, you shal take them away with the Ligaments vnlesse your care be the greater. They are crusted ouer with gristles, and touch the slippery side of the other bone. Solid they are, round, a litle depressed, sometimes gristly, sometimes bony, within fungous and full of pores, wherein they containe a iuyce which serueth them instead of marrow. *How to finde the seedbones*

These Seede-bones are commonly in each hand twelue, one standeth before the middest of the third ioynt, two at the second ioynt of the thumbe, [fig.1 & 2. S] two lesser which are gristly in the first knuckles of the foure fingers [Fig.1 ^T] which leane vppon tendons, and are bent on either hand at the sides of the ioynt with the double tendon. In the rest of the ioynts of the foure fingers, that is in the second and the third at each ioynt there is one bone which is placed before the middest of one single tendon, and these are much lesser, [Fig.1, V] and as it were gristly, but yet larger in the hands then in the feet: in old men they grow big and almost plaine, in children they are but gristly & scarse conspicuous in the Tendons. Their number is not certaine as is the number of other bones, partly because they are so small that they are lost in dissections, partly saith *Archangelus*, because for want of seede Nature omitteth some things which are lesse necessary in the frame of the body. *Their number*

There is one little bone amongst these Seede-bones which may be numbred twice [fig 12 ^M] because it is found in the hand nere the connection of that bone of the After-wrest which sustaineth the little Finger with the eight bone of the wrest, for it filleth vp a place there on each side.

The vse of these Seed-bones is foure-fold: the first, that in certaine motions by theyr hard-

hardneſſe they might be better able to receiue and ſuſtaine the violence of the bone moued; for the Tendon is defended with ſuch a ſmall ſeed-bone to keepe it from ſhouldring vpon it ſelfe; for, in the extention of the fingers they inſinuate themſelues ſomwhat into the ſpace of the ioynt, and returne or holde the Tendon leaſt in the motion it ſhoulde fall from the ioynt as it ſwels.

The ſecond vſe is to hinder the bone, at which it is ſet, from luxing eaſily out of his ioynt, & ſo they are a defence to the ioynts, like as in the great ioynt of the knee the whirl-bone is as it were a ſhield or Muniment to keepe the bones from luxation.

Their third vſe is to fill vp the diſtances which remained empty betwixt the bones of the fingers, and ſo againe they adde ſtrength vnto the ioynt.

Fourthly, to make the action of the hand which is apprehenſion more firme and conſtant. And this ſhall be ſufficient to haue ſaide concerning the bones of the whole hand, Onely we will adde.

That on the outſide of the fingers there are nayles ſet [Tab.22 fig.12] to make their apprehenſions more diſtinct and ſtrong, and theſe nayles are neyther longer nor ſhorter then the ends of the fingers are, and therefore when they grow longer wee pare them off, otherwiſe they would hinder apprehenſion. And thus much of the bones of the hand. Now we proceed vnto the Foote.

CHAP. XXXIII. *Of the bone of the Thigh.*

THE Ancients called al that the foot which is betwixt the top of the Thigh and the top of the great toe. The bones of the Foote are 42, and belong ſome of them to the Thigh, ſome of them to the Legge, and ſome to the Foote commonly ſo called.

The Thigh is called by the Grecians μηρὸν, by the Latines *Femur* a *ferendo*, becauſe the creature is borne or ſuſtained eſpecially by theſe parts. It is alſo called *Femen* although ſaith *Varro* in his fourth booke *Femina*, are properly the inner parts of the *Coxa*, and *Femora* the outward. The bone of the thigh is but one as is the bone of the arme. [Tab.23, fig.1,2,3.] In a man and an Ape it is the longeſt bone of the body, in other creatures wherein a great part of it lyeth hid, it is ſhorter then the Legge as it is in Birdes. The poſition of it is obliquely inward to the knee from the Hip-bone. The

The figure of it.

figure of it is long, round and ſtraight, but not exquiſitely becauſe it deſcendeth obliquely inward at the knee to make the ſtation or ſtanding, the walking and the running more firme and ſtrong, which alſo *Galen* euidently declareth in the 9 chap. of his booke *de vſu partium*, for thoſe men whoſe Thighes are more ſtreight and direct then it behooued, are called *Vari* and become lame in their knees. And it behoueth much that wee ſhoulde marke this poſture of the Thigh bone (being thereto councelled alſo by *Hippocrates*) leaſt if it be broken and to be reſtored againe, he that mends the breach ſhould turne it the wrong way.

On the foreſide it is gibbous, and that is profitable not onely for Seſsion and ſitting, but for many other labours or operations which are performed when we ſit, as if a man would write vpon his knee, hold a Viall or any other thing betwixt his legs, or lay one leg ouer another. In the ſides it is round and ſmooth on both hands, on the backeſide doked or hollow aboue, it endeth into a head, a necke and two proceſſes, below it determines into a head which hath two productions and boſomes.

The vpper Head.

The vpper head [tab.23, fig.1,2, ^ fig.3, x y the vpper] is wholy made of an orbicular Appendix which it hath, and is thicke and the largeſt head in the whole body. In ſo much as *Hippocrates* in his booke *de fracturis* cals it by an excellency ὦρθρον, *Articulum* the *Ioynt*. This head is round and long, the better to enter into the lap of the hip bone which is not onely deep of it ſelfe but indeed deeper by a large griſtle that compaſſeth the verges thereof.

And the reaſon why this cup was ſo deepe and the head ſo long, was that the articulation ſhould bee exceeding ſtrong becauſe of the enorme and huge waight which the thigh was to ſuſtaine. It is therefore articulated by *Inarticulation* which is a kinde of *Dearticulation*, and beſide to ſtrengthen it the more, and to faſten the two bones together, there ariſeth out of the cup of the hip an exceeding ſtrong and round ligament which is implanted into his *Sinus*, [Tab.23, fig.2, ^B] ſeated vnder the top of the head which is narrow and deepe. The head alſo is ſmooth and cruſted ouer with a griſtle that ſo the thigh might

might more easily and with greater expedition be bent, extended, mooued to the sides and circumflected or turned about.

Vnder the head is the necke of the thigh called αὐχὴν *Ceruix.* Ta.23,fig.1,2,3,[p] It is long and reaching vpward reclined also obliquely inward, least the thighes motion should haue beene hindered. Out of the necke where the bone groweth broader vnder [p] doe arise two knots which they call processes, or *Trochanters*, or *Rotatores*: and these Trochanters haue Appendices [Tab.23,fig.3,the middle[x]] which in children new borne (as also the head it selfe) may easily be separated, but in growne bodies they are so vnited with the prominent parts [fig.2,[s] with [v] fig.1,[a] with [b]] that there remaineth scarce any signe or footstep of an Appendix. The necke.

The vpper of these [fig.2,[s-v]] is the greater, and of all the processes in the body which are not ioyned to another bone simply the greatest: it bendeth vpward and outward. The lower [fig.1,2,[a]] is farre lesser and looketh backward and inward. And both these are called *Rotatores*, eyther because they were made to turne the Thigh, or rather because the muscles which accomplish the motions of the Thigh are inserted into them. The first is called the great Trochanter and μέγα τοῦ, eyther because it is something like the Buttock, or because the muscles of the buttocke are inserted into it. The other is called the lesser Trochanter. These two processes are ioyned together by a line which buncheth out behind and runneth from without inward and so the bone of the Thigh becommeth round.

The vse of these Trochanters is like a little hill to admit the insertion of some muscles and to others to afford place of originall, for into the inner Trochanter is infixed the tendon of the first and second muscles which bend the Thigh: close vnto this there runneth a rough line [fig.2,[ee]] obliquely downward and backward which seemeth to be parted into two and to reach vnto both the heads, but is more euidently terminated at the vtter head and into this line is the eight muscle of the Thigh implanted adhering verye closely thereto, for by the helpe of that muscle especially we stand vpright. The vse of the *Trochanters*

At the vtter processe there is a *Sinus*, certaine impressions, and a line to be obserued. The Sinus [fig.2,[t]] reguardeth the head of the Thigh, and into it are the ninth and tenth muscles of the thigh inserted. The impressions are foure at the vtter gibbous part which receiue the Tendons of foure muscles. The first in the backward and lower side; [fi.2,[s]] it is a large impression which receiueth the tendon of the first muscle of the thigh, [fig.1,[τ]] in the foreside which is also the rougher and receiueth the tendon of the seconde muscle; the third in the vpper and vtter part [fig.1,[β] below τ and υ] which is gibbous and made to receiue the tendon of the third muscle: the fourth [figu.1,and 2,[v]] is in the very top of the processe and narrower then the rest, and admitteth the tendon of the fourth muscle. But from the roote of this processe on the anterior and the exterior side ariseth the seauenth muscle of the head. The line wee spake of is rough and runneth from the first impression downeward and somewhat obliquely through the backside of the thigh, and into it is the first muscle of the thigh implanted. The sinus of the thigh.

The line.

Now below the middle Region the Thigh as it descendeth [fig.2.from [d] to [e]] it becommeth thicker, is dilated and depressed, [fi.2.[e]] in which depression a veine, an artery and a nerue do securely run, and at length it determineth into an ample and broad head, which latitude is made by a large Appendix. [ta.23.fig.3.[x y] the lower] Out of the backeside of this head are produced two processes as it were two other heades, [fig.1 & 2 [z f]] betwixt which there is a large space left about an inch broade, [figu.2.l] which receiueth a protuberation swelling out of the head of the Leg-bone.

These two heades are on the outside rough, but their superficies is smooth, because of a gristle which compasseth them to make the motion at the knee more expedite or easie. These heads doe bend more backward, and in the sides are scarce depressed at all, because of the articulation of the Thigh with the Legge-bone. [ioyne ta.23.fig.1 and 2.[z f l], with ta.24.fig.7.[g f]] which is made by *Gingglymos*, for these two heades of the Thigh doe sit in two bosomes or cauities of the Legge-bone, and the protuberation of the Legge bone which swelleth vp betwixt his sinus [ta.24.fig.7.l betwixt [e] and [f]] is receiued by the posterior sinus of the Thigh-bone. [ta.23.fig.2.l] Moreouer the Thigh is fastned with the Leg below, as it was aboue with the Hip-bone by a strong ligament produced from the protuberation of the Leg-bone. The lower heads of the thigh,

Of these heads, one is internall which is the thicker; another externall which is broader and more depressed, least both of them should bee equally articulated to the Legge

Table 23. Figure 1 and 2 shewe the fore and hinder part of the thigh-bone.

Figure 3 sheweth the thigh, whose Appendices wee haue remooued out of their place, and disioyned with a little distance.

Figure 4 and 5. The fourth sheweth the anterior and rough side of the Pattel-bone; the fift his posterior part crusted ouer.

TABVLA XXIII.

A 1,2. The head of the thigh going into the Cup of the Hip-bone.

B 2, A sinus into the head of the Thigh, into which is inserted a round Ligament.

C 1,2, The coniunction of the Appendix of the thigh with the bone it selfe.

D 1 2,3, the necke of the thigh.

E,F, the two lower heads of the thigh.

G 1,2, the coniunction of the lower appendix,

H 1, I 2, A sinus betwixt the two heades of the Thigh.

K 2, A part of the lower heade of the thigh from whence the first muscle of the foote doth proceede.

L 2, Another part from whence the seconde and third Muscles arise.

M 2, Another part to which the Tendon of the fift Muscle of the thigh is infixed.

N 1,2 A sinus of the outward side of the head for the fourth muscle of the legge.

O 2, A sinus of the inside through which the tendons do passe.

P 2, a protuberation at which the saide tendons are reflected.

Q 2, the vtter processe of the thigh, and betwixt Q and D is the sinus.

R 1,2, the vnion of the processe with the thigh.

SS 2, a rough line from the impression of the externall processe.

T 1, the anterior impression of the internall processes.

β, betwixt T and V another impression higher then the former.

V 1,2, the fourth impression in the toppe of the processe.

X 3. Foure X, shew the foure appendices of the thigh.

Y 3, Three Y shew the three heades of the thigh.

ZZ 3, Two processes of the thigh.

a 1, the anterior processe of the thigh

b 1, the coniunction of the processe with the thigh.

cc 2, a line descending obliquely from the inner processe.

dd 2, a line running thorough the length of the thigh.

e 2, The largenesse of the thigh in this part.

f 1 a roughnesse from which the eight muscle yssueth. *g*,*b* 5, a knub of the Whirle-bone going into the sinus marked with I which is betwixt the heads of the thigh. *i* 5, a sinus fitted for the inner head of the thigh *k* 5, a sinus agreeing with the externall head of the thigh. *l* 5. The lower asperity or roughnesse. *m* 4, The foreside of the pattell or whirle-bone rough or vnequall.

and so the oblique motion made by the muscle of the Ham called *Popliteus* bee interrupted; for this muscle yssueth from the externall heade where it is exasperated with small cauities, and these heads as is saide doe enter into the sinus of the Legge-bone. From these processes as it were, the three first muscles that moue the foot take their Original, as also the tendon of the fift muscle of the thigh is infixed into the side of the inner head, [M] where the compression is marked. [figu. 2 R] Their sides are full of blinde holes, out which do yssue the Ligaments which hold together the ioynt of the knee.

They haue also foure sinus or cauities, two in the middle of the head, and one in the sides on either hand. The first of these which is the forward [tab. 23. fig. 1 [II]] is crusted ouer with a gristle and receyueth the protuberation of the Pan: [figu. 5. [gh]] the second and the backward [fig. 2 I] is deepe, rough and vnequall, and receyueth the protuberation of the

Legge-

leg-bone:[ta.24,fig.7,I] the third is at the outside of the head,[fig.12,N]through which the tendon of the fourth muscle of the legge reflected in this place is safely transported: the fourth Sinus is at the inner head [fig.2,O] wherein the tendons of the first, seconde, third and fift muscles of the legge are safely conuayed.

On the foreside at the roote of the necke the thighbone is large and rough, [fig.1,^{c}] so framed for the originall of the eight muscle of the legge: on the backside it buncheth out with a rough and vnequall line [fig.2,^{dd}] into which the fift muscle of the thigh is infixed.

Finally, on the outside throughout the length of the bone there is a large *sinus* or cauity made not so much for lightnes as to containe great store of marrow for nourishment and therfore the vpper part of the bone,but especially the lower,is thrilled through with many small perforations whereinto the veynes are admitted which bring blood vnto that place.The vse of the thigh is for progression; now some creatures do moue right vp,some bending downeward,and this variety is made by the different insertion of that round and strong ligament which yssueth out of the Thigh and is inserted into the cup,for if the insertion be made,saith *Archangelus*,toward the vpper part of the cuppe, then the creature walketh streight vp as a man doth,if it be inserted toward the laterall parte then his gate is prone or inclined to the earth, as an Oxe or an Horse. And thus much of the bone of the Thigh. The vse of the thigh.

CHAP.XXXIIII. *Of the two bones of the Legge.*

WEe call all that the Legge which is betwixt the knee and the in-step, and it hath two bones as the Cubit had, [Tab.24,figu. 1,and 2,] and surely if it had consisted of one thicke and great bone it would not haue beene so fit for motion,which would haue beene hindered by the grauity or weight thereof, as *Galen* excellently sheweth in the 13 chap.of his third booke *de vsu partium*. Of these bones the inner is called κνήμη, *Tibia*,carying the name of the whole, and so we call it the Leg-bone,[fig.3,4,the vtter is called περόνη *Fibula*, [fig.1,and 6,] wee call it the Brace bone or if you will the Shinne bone. The names of the bones of the legge.

The Legbone is called *Tibia*, haply becausе it is like a Fluite, it is called also *Canna maior*,for so also a Fluite in latine is called. If you will for difference sake we may call *Tibia* the Shanke,and *Fibula* the Shin bone, or if you had rather retaine the vertue of the latine names call *Tibia* the Leg-bone and *Fibula* the Brace bone. The leg-bone is the inner and the thicker,somwhat shorter then the Thigh to which it is ioyned, otherwise it is the longest of all the bones.

The figure of it is long and three square, thicke aboue and below and eeked with an Appendix. [Tab.24,fig.1,and 3,$^{A\,a\,DD}$] It is also made vnequall with long cauities and lines and is articulated aboue with the Thigh,below with the *talus* or Coccal,or bone of the instep by *Ginglymos*. His figure.

The vpper part which they call the vpper head is broader then the lower, for the legge was made to beare the thigh, and this bredth is formed by an Appendix which is set like a cup vppon the head of the bone. [tab.24,fig.1,3,$^{A\,a}$] This Appendix is thicke and before inclineth somthing more downward then it doth behind, [fi.1,3,^{B}] it hath two long Sinus, [figu.2,and 7,$^{E\,G}$] which are but shallow and crusted ouer with a slippery Gristle whereinto it receiueth the two heads of the Thigh.[ta.23,fig.2,E,F,]and so a *Gynglymos* is made.But becausе the proper cauity of these Sinus was not deep enough to receiue the length of the heads of the thigh an amends is made and the Sinus encreased in al cretures by a peculiar gristle [fig.8,] like a halfe moone, which is therefore called *Cartilago Lunata*, the *Crescent Gristle*; and this gristle is softened by ligaments. This gristle is mooueable and thicke in the circumference or Verge,[fig,8,^{N}] & yet toward the Center it is alwayes attenuated [fig.8,^{oo}] toward the Center I say,for it doth not reach so farre as to the Center but endeth on eyther hand into sharpe tops, [fi.8,^{pp}] yet so that before these tops doe meete; for the right is ioyned to the left,but behind they are more distant to giue way to a thick ligament that passeth betwixt them. The gristle also is slippery,smooth, and soft, ful of an vnctious or oily humor to furher the motion of the ioynt,and it supplyeth the office of a ligament. His vpper part. his gristle.

These two Sinus are separated by a rough and vnequall protuberation [fig.7,H I K] growing out of the middle superficies of the leg and shank-bone, which protuberation is

receiued by the ſinus of the thigh [tab.23.fig.2 I] which is betwixt his two heads. Out of the rough and ſinuated top [tab.24.fig.2,3,4:7 I] of this protuberation on the backeſide yſſueth [tab.24.fig.2 47 K] a ſtrong Ligament which is infixed into the middle of the ſinus of the thigh, [tab.23.fig.2 I] that the ioynt being thus on euery ſide defended, might the better be contained in his owne place. From the anterior part of the protuberation [tab.24.fig: 7 H] which is rough and ſinewated, are produced certaine Ligaments which on the foreſide of the protuberation doe ioyne the griſtles together which encreaſe the cauities of the ſhanke, [fig.8, LM] although alſo they grow together by the interpoſition of that orbicular or round Ligament which compaſſeth the knee.

His Head. Out of the Appendix at the vtter ſide of the legge ariſeth a little head [ta.24.fig.4 R] which is cruſted ouer with a griſtle and entreth into the vpper ſinus [fig.5. ☾] of the Appendix of the Brace or ſhin-bone, ſo the anterior part which is next to the appendix [ta. 24.fig.1,3,7 ab] is rough and full of holes; whereinto the tendons of the Muſcles that mooue the legge are very ſtrongly inſerted.

From hence the Leg-bone is by degrees attenuated, diuerſly alſo diſtinguiſhed vvith lines and cauities, and imitateth the forme of a triangular; for it hath one corner like a long and ſharpe edge which is ſituate in the forepart; the ſeconde corner is in the Vtter part, the third in the inſide; and betwixt theſe Angles the bone lies plain but lightly excauated, as well to make it more light, as alſo for the inſertion and original of the Muſcles. On the backſide it is round.

His Lines. The anteriour part and the middle is produced or lengthened vnto an acute and long angle, [tab.24.fig.1,3 γ γ] which angle is as ſharpe as the edge of a knife, and therefore it is called *ſpina tibiæ*, the ſpine of the Legge by the beſt Anatomiſts.

The ſecond line [tab.24.fig.1,2,3,4 δ δ] which maketh the vtter angle of the backſide is alſo ſharpe, and is ſeated vnder the Brace: this line receiueth the Ligament which faſteneth the ſhin and the ſhank-bones together.

The third line [fig.1,2,3,4 ε ε] which maketh the internall angle of the backeſide is blunt and almoſt round. Wherefore theſe lines do make the three ſides of the leg. The firſt ſide [fig.1,3 ζ] is ſinuated but plain, and together with the ſide of the Brace [fig.1,5 κ] it affoordeth a place vnto the anterior muſcles which deſcend vnto the foote. The ſecond ſide [fig.1,3 η] is inner and gibbous which by ſome is called ἀντικνήμιον, by ſome κρέα, in a contrary Senſe, becauſe it hath no fleſh at all, although the other ſides eſpecially behind be very fleſhy. The third ſide [fig.2,4 θ] the poſterior muſcles of the Thigh do occupie, and in it, aboue we meete with another rough line running obliquely downward [fig.2 N] [fig.4, ν] made for the inſertion of the muſcle of the Ham.

His Sinus. On the outſide aboue the lower heade there is alſo a long ſinus which runneth backeward, [t.24.fig.4,10, ς] which receyueth the interior part of the head of the brace-bone which is a little rough, [fig.5,6,11, τ] and ſo the Brace and the Leg, or the ſhin and the ſhank are ioyned together; but where theſe bones are conioyned there commeth a ſtrong Ligament betwixt them, which faſteneth them together both in the circumference, and where they touch one another. So alſo behind it is depreſſed [fig.2,4 m] and ſheweth as it were three ſinus which conuey the three Tendons of the fift muſcle of the foote, and the two benders of the toes, for theſe muſcles run out vnto the foote.

The lower part of the leg The lower part of the Legge or the lower heade is thicke, which for all the appendix that is added and the plentifull griſtle wherewith it is cruſted ouer and made broader is notwithſtanding leſſer then the vpper, whoſe Appendix together with the appendix of the Brace, do make in the ſurface a large ſinus [fig.9, defgh] which receiueth the *Talus* [tab.25,fig.3,4,5,6] or the Coccall-bone: but in the appendix of the leg bone there is as it were a double ſinus [figure.9,10 e f] diſtinguiſhed by a ſwelling knot which buncheth lightly in the middeſt betwixt them. [fig.7,10 d]

It hath alſo a thicke proceſſe yſſuing from the inſide, [tab.24.fi.1, Φ,2,3,9,10 i] which proceſſe in that part that regardeth the ſinus, [fig.9, ξ] is hollow, ſmooth and cruſted ouer with a griſtle whereby the cauity is enlarged, and by that means it receyueth the *Talus* more commodiouſly, for that being inſerted into the Sinus it cannot be mooued out of his place. The other ſide of the proceſſe which regardeth the other Legge is gibbous and without fleſh. [fig:2,3,9,10 i] But in the oppoſite part the legge could not haue had another proceſſe, becauſe it was neceſſary that in it there ſhould bee a long ſinus, into which a part of the Brace-bone was to enter.

This

Table 24. sheweth the bones of the Legge and the Brace, together with the gristles about the knee.

Fig. 1 & 2. shewe the right Legge whole, both the fore-part and the back-part.

Fig. 3 & 4. shew the foreside and the backeside of the Legge or Shank-bone.

Fig. 5 & 6. shew the foreside and the backside of the Brace or Shin-bone.

Fig. 7. sheweth the vpper part of the Shanke-bone to which the thigh is articulated.

Fig. 8. two gristles increasing the cauity of the ioynt of the Leg-bone at the knee.

Fig. 9: the lower part of the whole Leg where on the foreside it receiueth the Talus or the Instep.

Fig. 10. the backpart of the lower end of the Leg-bone.

Figure 11. sheweth the inside of the lower end of the Brace or Shin-bone where it is articulated with the Talus or Instep.

TABVLA XXIIII.

AB 1, The vpper Appendix of the Legge or shanke-bone.

AB 2,3, The line where the Appendix ioyneth with the bone.

C 1, The vpper appendix of the Brace-bone.

C 5, the coniunction of this appendix with the bone.

DD 1, the lower appendix of the Leg-bone.

D 3, the coniūction of this appendix with the bone.

E 1, the lower appendix of the Brace or shin-bone

FG 2, 4 7, the bosomes of the bones of the Leg receiuing the heads of the thigh bone.

HIK 7, A protuberation which is betwixt these cauities; K L in the second, third and fourth figures doe shew the same.

LM 8, a gristle encreasing the outward cauity of the Leg-bone L, another increasing the inner cauity M.

N 8, the foresaide gristles do in this place appeare thickest.

O 8, and here they appeare thinnest.

P 8, here they do determine into sharp points

Q 5, A shallowe *sinus* of the Brace bone t which the head of the leg-bóe is articulated.

R 4, the head of the Legbone which is ioyned to the Brace.

S 4, 10, A *sinus* of the Legbone receiuing the lower end of the Brace bone.

T 5, 6, 11, the inside of the Brace where it is ioyned to the bone of the Leg.

V 2, the context or coniunction of the Brace with the Legbone aboue.

X 2, the same coniunction below.

Y 2, the distance betwixt the shanke and shin bones.

Z 1, 2, The oblique turning of the Brace inward which on the outside is somwhat indented.

a b 1, 3, the forepart of the Legbone wherinto the muscles which extend the Leg are inserted.

c 5, 6, the vpper processe of the Appendix of the Bracebone, whereinto is inserted the tendon of the fourth muscle of the Legge.

d e f g h 9, At this place the vpper part of the *talus* or instep is articulated: in the ninth & tenth figures *d e f* shew the vpper region, but *d* noteth the protuberation.

h 9, 11, the outside where it is fitted with the instep.

i the inner ankle or a processe of the inner appendix of the Legbone.

i 2, 3, 9, 10, the inner ankle.

k 4, 10, a *sinus* of the inner ankle from whence a gristly ligament is inserted into the instep

l 1, 3, 9. an vnequall *sinus* in the lower appendix of the Legge bone, whence groweth a gristly ligament which is sent vnto the necke of the instep.

m 2, 4, 10, certaine *sinus* through which three tendons are led to the foot.

n 2, 5 6, 9, the outer ankle or the processe of the shin bone in the first figure noted with E. *o p* 1, 5, that part of the shin bone which is bare. *q q* 2, 6, in this situated place of the shin bone the tendons of the seauenth and eight muscles of the foot are reflected *r* 2, 6, 11, a *sinus* of the appendix of the shin bone from whence goeth a ligament into the instep. *s s* 1, 5, the first line of the shin bone. *t t* 2, 5, 6, the second line of the shinbone. *u u* 1, 2, 5, 6, the 3 line of the shin bone. *x x* 1, 5, the first side of the shin bone bunching a little out. *α α* 1, 5, the 2 side of the shin bone. *ββ* 2, 6, the 3 side of the shin bone. *γγ* 1, 3, the first line of the leg bone. *δδδδ* 1, 2 3, 4, the 2 line of the leg bone. *εε* 1, 2, 3, 4, the 3 line of the leg bone. *ζ* 1, 3, the first side of the legbone. *η* 1, 3 the 2. side of the leg bone. *θ*, 2, 4, the 3, side of the leg bone. N 2, *κ* 3, 4, a rough line of the third side of the leg bone made for the muscle called *Popliteus*.

This proceſſe is by degrees dilated and determineth into two browes, wherefore alſo the ſhinne-bone or the *fibula* departeth into a proceſſe, that ſo the bone of the *Talus* might be contayned or kept in by both the proceſſes, that it ſhould not ſlippe out on this ſide nor on that ſide. And if at any time the luxation of the *Talus* doe happen, it is rather to the inner proceſſe then to the vtter, becauſe the proces of the *Brace-bone* is lengthned out ſomewhat longer then the other.

The Ankles

Theſe proceſſes are called σφυρὰ *malleoli* the Ankles, the proceſſe of the Leg-bone is called the inner ankle, and the proceſſe of the *Brace-bone* is called the vtter ankle.

The inner ankle.

The inner Ankle [figure 1,[p] fig,2,3,9,10,[i]] in the lower end of the backepart hath a rough *ſinus* [fig,4,10,[k]] whereout yſſueth a griſtly ligament whereby the bone of the leg is faſtned to the *Talus*, ſo likewiſe in the lower and foreſide [figu,1,3,9,[l]] of the appendix there is a *ſinus* rough, tranſuerſe and long, from whence groweth a ligament which faſtneth the necke of the *Talus* [ta.25,fig.3,[n]] to the leg-bone.

His vſe.

Finally, this bone as alſo the *Brace* is notably hollowed within, and that cauity conteyneth they marrow, neither is it without other perforations. The vſe of the Leg-bone ſayth *Archangelus* is to make the progreſsion more expedite and nimble. And thus much of the Leg or Shank-bone.

Of the Brace or Shin-bone.

The brace bone.

His names.

The other bone of the Legge is called περόνη *Fibula*, becauſe as in buildings thoſe Irons whereby the beames and pannes are ioyned together are called *fibulæ* or *braces*, ſo this leſſer bone may alſo be well called the *Brace*, becauſe it ioyneth together the muſcles of the Legge: it is alſo called *canna minor*, and in Engliſh if you will the Shin-bone. It is ſeated on the outſide of the Leg as the wand is on the outſide of the Cubit; aboue it entreth into a plaine and cruſted *ſinus* of the Leg-bone [fig.5,[o]] vnder the head thereof; [tab,24,fig,1,[c] vnder [a]] below it entreth into a long *ſinus* of the Legge. [fig,1, from [x] to [p]] At both the ends it is articulated by *Arthrodia* or *adarticulation*, whoſe motion is obſcure. In the middeſt the two bones doe ſtand off one from another [figure 2,[y] betwixt [y] and [x]] that ſo the muſcles of the foote might finde place between them eſpecially in the vpperpart, becauſe there the Leg is bent into a *ſinus*. In this diſtance there is a membranous ligament which faſtneth the skinne and the ſhanke-bone together. The length of the *Brace-bone* is equall to the length of the other, for although aboue, it do not aſcend into the knee, yet belowe it deſcendeth lower then the ſhanke-bone, but in breadth and thickneſſe it commeth farre ſhort. Moreouer a little vnder the middeſt it is ſomewhat curued toward the Legbone, and the outſide is after a ſort concauous, [fig,1,2,[z]] yea to ſay true, the figure of it is not much vnlike the figure of the Leg-bone it ſelfe.

His heads

the vpper.

It hath two heades, one aboue and another below whereto there groweth an Appendix which endeth into an acute proceſſe ſomewhat exaſperated. The vpper of theſe is below the head of the ſhanke-bone, [figu,1,[c] vnder [a]] which is defended with an Appendix and cruſted ouer with a griſtle: it is round, and on the outſide ſwelleth very notably, [figu,5,[b c]] the better to receiue the tendon of the fourth muſcle of the Legge, as alſo to giue an originall vnto the head of the ſeauenth muſcle of the foote. The Appendix of this head hath on the inſide a large and ample *ſinus* [figure 5.[s]] cruſted ouer with a griſtle whereto the head of the Appendix of the Leg-bone is articulated [fig,4,[s].]

the lower.

The lower head tendeth into a ſharpneſſe [figu, 1,[z]] and deſcendeth ſo much lower then the Leg-bone, as the head of the leg-bone aſcended aboue the *Brace* in the top; it is alſo furniſhed with one appendix [fig 1,[x] 2,5,6,9,[n]] which growing thick departeth with a proceſſe called the outward ankle, which deſendeth ſomewhat lower then the vtter ankle and maketh the externall ſide [fig.9.11.[h]] of the common *ſinus* [fig.7.[d e f g h]] which receiueth the *Talus* or bone of the inſtep, and is cruſted ouer with a griſtle. This ankle is lower then the inner, and on the outſide gibbous, ſome part of it alſo may bee felt without fleſh, and from it ſome muſcles of the foote properly ſo called take their originall, on the inſide it hath a rough *ſinus* [fig.2,6,11,[r]] out of which ariſeth the griſtly Ligament which faſtneth the *Brace* or ſhin-bone to the inſtep. Aboue the Ankle there is a *ſinus* [fig.2,6,[q]] couered with a tranſuerſe Ligament, where vnder the tendons of the ſixt and ſeauenth muſcles of the foote are ſafely conuayed.

the lines.

Betwixt theſe two heads the body of the *Brace* or ſhin-bone is vnequall, becauſe of cauities and lines therein made for the inſertion of muſcles: ſo that about the middle it

ſeemeth

ſeemeth to be triangular; for before there appeareth an acute and ſwelling line;[fi,1.2.ff] behind it is depreſſed and hath on either hand a ſtrutting line,[fig.1,2.5.6.ττ] and theſe lines make the three ſides of the *Brace-bone*. [fig,1,5,χα 2,6.β] In like manner at the lower end aboue the appendix [fig.5.6.11 τ] there buncheth out an aſperity, at which place by the interpoſition of a ligament it is faſtned to the ſhanke or leg-bone.

The vſe of the *Brace-bone* is threefold: the firſt to ioyne the Leg and the Inſtep, whereby the foote is bent and extended: ſecondly to defend the veſſels and muſcles of the Leg from outward injuries, for the *Brace-bone* couereth for the moſt part the courſe of them all. Thirdly, to ſuſtaine, ſtrengthen and ſecure the Legge by faſtening it to the outward head of the Thigh-bone. Moreouer, as the wand helpeth to moue the Hand, ſo the *Brace-bone* helpeth to moue the Foot in compaſſe, ſaith *Archangelus*. The vſe of it.

CHAP. XXXV. *Of the whirle-bone of the Knee.*

BEfore we part from the Leg, you muſt remember that there is a bone placed before the ioynt of the Knee [tab.23.figu.4.and 5.] which the Grecians call ἐπιγονὰλις & ἐπιγονὶς, becauſe it lieth vpon the knee; others call it μυλη the Mil-ſtone, becauſe it is very like it. *Celſus* calleth it *patella* or the *Sawcer*. It is alſo very commonly called *Rotula*, we will call it the Whirle-bone. The names of the whirle bone.

It is a bone common to the Thigh & the Leg although it be ſeparated from them both, for it is placed before their articulation. In each knee there is one, ſomewhat round and broad and ending into a ſharpneſſe where it reſteth vpon the Leg. The magnitude of it is moderate, the latitude ſcarce two fingers broade, the longitude is ſomewhat thereabouts, the thickneſſe is vnequall, for in the extremities it is thinne and growes thicker by degrees, ſo that in the middeſt it buncheth out like a compaſſed buckler, or if you will, like an embowed Looking glaſſe ſuch as they vſed in ancient times. The vpper part therof groweth to the thicke Tendons of the ſeauenth, eight and ninth muſcles of the Thigh, which by the knee doe runne vnto the Leg: by theſe Tendons it is eſtabliſhed, for they ſerue it in ſteade of a Ligament to faſten it both to the Thigh and to the Leg: moreouer on the outſide it is couered by them; on the inſide it is cruſted ouer with a ſmooth and ſlippery griſtle, at leſt the greateſt part of it; eſpecially where it reguardeth the Thigh, and this griſtle maketh the motion more glib, for it will eaſily moue vnder a mans finger. *Columbus* cannot taſte this conceit, but ſayeth that it is faſtned both to the Thigh and to the Leg by Ligaments of his owne, which ſayeth hee doe grow from the Appendices of the Thigh and the Legge, ſo alſo ſayth *Archangelus*, yet he doth not deny but it is eſtabliſhed by the Tendons of the muſcles before ſpoken of. But *Bauhine* leaneth more to the firſt opinion of *Veſalius*, that it hath no other Ligaments but the Tendons. If theſe Tendons to which it groweth be cunningly taken away it will appeare both before and in the ſides [ta.24.fig.4.] rough and full of blind holes, but behinde it hath a moderate protuberation [fig.5.g h] and ſhallow boſoms on either ſide [fig.5.i k] cruſted ouer with a griſtle of which the vtter is the larger and the broader. How it is faſtned.

This protuberation wee ſpake of, is receiued by the *ſinus* which is betwixt the heads of the Thigh, [f.1.ᴿ betwixt ᴱ ᶠ] like as the boſome of this whirlebone receiueth the heads of the Thigh; wherefore the Thigh receiueth the whirle & the whirle the Thigh, and ſo are ioyned by *Ginglymos*, but the whirle and the Leg-bone are ioyned by *adarticulation*: wherefore it is moouable leaſt it ſhould make the motion of that ioynt difficile or hard. Moreouer the inner and lower part [fig.5.ˡ] where it groweth into a proceſſe and reguardeth the vpper part of the Legge-bone, is rough and perforated that it might growe the faſter to the Tendons of the foreſaid muſcles. His articulation,

The ſubſtance of the whirle is at the firſt griſtly and ſo remayneth for certain months. Afterward it groweth as hard as a hard Appendix, and at length bony, hard & ſolid, ſuch as it appeareth in growne bodies, ſo ſayth *Fallopius* in his obſeruations, and with him *Bauhine* conſenteth; *Columbus* thinketh it groweth not beyonde the height of an hard Appendix.

The vſe of it is to couer and to firme the laxe and diſſolute compoſition of the ioynt of the Thigh and the Leg, leaſt in progreſsion and walking the Thigh ſhould luxe outward, as alſo that when we goe downe a hill it might ſupport the ioynt. Moreouer, by the help of the whirle when the knee is gathered directly backward it is bent into a right angle.

Finally

Finally, it defendeth the Tendons of the foreſaid muſcles, leaſt in the bending of the knee when the Thigh bone preſſeth forward it ſhould beare to hard vppon them; and in a worde as the Seede-bones of which wee ſpake before, the hardneſſe of it receiueth the violence of the Thigh-bone, and breaketh it that it ſhoulde not compreſſe thoſe Tendons.

CHAP. XXXVI. *Of the Bones of the foote properly ſo called, and particularly of the Wreſt of the Foote.*

WE are now come vnto the third and laſt part of the Foote, which is properly called the Foote, and *Pes extremus* or *Pes paruus*. It hath 38. bones and three parts. The firſt part is called *Tarſus*, which we call the wreſt of the Foot, and hath ſeauen bones.

The ſecond is called *metatarſus* or *pedium*, the Afterwreſt of the Foote & hath fiue bones.

The third part is of the Toes, which haue foureteene bones, to which wee may adde twelue Seed-bones. Of theſe in order.

Of the ſeauen bones of the *Tarſus* or wreſt of the Foot: foure haue names, the other three are not ſo much beholding yet vnto Anatomiſts.

The firſt bone of the *Tarſus*.

The firſt [ta. 25, fig, 1. and 2. Γ and the whole third, fourth fift, and ſixt figures] which the Greciancs cal ἀστράγαλος and ἄστριον, the Latins *Os baliſtæ* and *Talus*. The Dye or paſtern bone lyeth vnder the Appendices of the ſhinne and ſhanke-bones as a firme and ſtable foundation, and yet it ſeemeth to lye onely vnder the ſhanke, and this bone is not onelye found in men but in all other creatures whoſe feete are deuided into Toes. In the vpper part thereof there is a ſmooth and round knub [fig. 3.4.6.ABCD] cruſted ouer with a griſtle, which repreſenteth the forme of the nut of a Croſſe bow or the fourth part of a wheele. The ſurface alſo of the knot is as it were foure ſquare, limitted about the edges with foure ſides, and therefore by ſome is called *quatrio*: the firſt and ſecond of theſe [fig. 3. 5. 6. from A to B and from C to D] goe through his length: the third is on the foreſide [from A to C] the fourth on the backſide. [from C to D] In the middle it hath a ſhallow cauity [fig. 3.EE] with riſing ſides [figu. 3.FF] like the ſides of the furrow of a pulley wherein the rope runneth, by which *ſinus* it is coupled by *Ginglymos* with the appendix of the ſhankbone. [tab. 24. fig, 9. 10.def] The ſides of it are plaine and ſloping, cruſted ouer with a thinne griſtle to receiue the Ankles: the inſide [fig. 5.G] is cruſted but a little way, and receiueth the inner Ankle of the Legge: the outſide is broader [fig. 6.H] and more hollowed, deſcending lower the better to admit the outward ankle of the Brace-bone which alſo deſcendeth lower. [tab. 24. fig. 9. 11.b] And thus the *Talus* is ioyned with the Leg and the Brace, which articulation ſerueth for the right motion of the foote, which that it might more eaſily perfourme and without attrition of the bones, it is on both hands cruſted ouer with a griſtle.

Furthermore, on the inſide it hath a rough *ſinus* [figu. 5. I] where into a griſtly Ligament is receiued which groweth from the inner ankle, and whereby the *Talus* is faſtned to the ſhanke. Againe, on the outſide fig. 6.K] there is another *ſinus* which receiueth a Ligament produced from the outward ankle. Moreouer, on the backſide at the root of the protuberation where it is ioyned to the Leg and the heele [fig. 5. after ZD] there is a roughnes, partly to receiue the ligaments which grow from the Leg, partly to reach other ligaments vnto the heele. There is alſo in the backepart [figure 5.6.LM] a *ſinus* prepared for the tranſition of the tendons of muſcles which attaine to the ſole of the foote.

Yet further, this firſt bone is not onely ioyned with the ſhin and the ſhanke, but alſo with the *Boate-bone*, and therefore the forepart of the *Talus* is lengthned into a long neck, [figu. 3,4,5,6,N] and the necke endeth into a round head [O] couered ouer with a ſlippery griſtle which is receiued by the large and round *ſinus* or boſom [fig. 11.K] of the *bote-bone*, and by the meanes hereof the foote is moderately and with an obſcure motion mooued inward and outward, and ſomething alſo in compaſſe.

At the Heele alſo this *Die* or *paſterne-bone* is faſtned with a double ioynt, and therfore the lower part thereof hath on the backſide a large and deepe *ſinus* [fig. 4.Q] couered ouer with a griſtle, into which the large and broad head [figu. 7.8.9.P] of the heelebone is inſerted: before it hath a long and ſmooth protuberation [fig. 4.S] which is receiued by a long boſome [figu. 7.8.9.R] on the backſide of the heele. Betwixt theſe two ſpaces or in the

the middest of these ioynts there is a deepe and rough cauity [figu. 4, ᵀ] whereto the sinus of the heele [fig. 7,8,9, ᵀ] is opposite and answerable: the vse of which cauity is to contain a mucous substance and fat withall, whereby these bones are moystned that they should not grow dry by perpetuall motion. Moreouer in the same cauity doe grow these gristly ligaments which in this place doe very strongly binde the *Die bone* to the heele, and therefore when the bones are cleansed and afterward fastened together, there remayneth in this place a great distance. Sometime also on the backeside it is extended aboue the heele where it bends inward as it were into a double small processe. It hath no appendix for it hath need of equall strength on euery side: neither receiueth it the insertion of muscles, neither doth it offer originall vnto them.

The substance of this bone in the originall as also of all the other bones of the wrest of the foote, excepting the heele is a gristle, but in growne bodies it is on the inside fungous, yet where the processes break forth, solid and dense, sauing that it is perforated manifold.

The second bone of the Wrest [fig. 1. and 2, ᴬ and the whole seauen, eight and nine figures] is called in Greeke τάρσα *Calx, calcaneum, pedis calcar*, in English the Heele. This is the greatest and the thickest bone of the whole foot properly so called, and was so made for more strength and firmitude. For the extention and flexion of the foote are made by the articulation of the *Talus* or Dye-bone to the bones of the Leg and the *brace*. Againe, the motion of the foote to the sides, is wrought by the coniunction of the *Talus* to the *boate-bone*: the rest of the connexions of the bones which are many and small do little assist the former. *The second bone of the wrest. The heele,*

As therefore the *Talus* or *pasterne* bone is the principall agent in the motions of the foote, so is the heele the principall firmer and establisher thereof. And vnlesse the heele had beene greater then the *Talus*, not onely the *pasterne* it selfe but the shanke also would slip backward, for it lyeth directly vnder the shank and almost alone supporteth it, and by it the Thigh, and by the Thigh the whole body. It was therefore very necessary that it should be a notable large bone, or else Nature had beene very improuidēt to lay so great a weight vpon it. It behoued also that his articulation should be very firme, not wauering or vnstedfast, and therefore Nature ioyned his processes with many hard, gristly, broade and round ligaments, not onely to the *pasterne* bone but also to other bones neare adioyning to make his strength more assured. VVherefore it doth not onely lye vnder the *talus* and sustaine it, but is also articulated thereto and to the cube. To the *Talus* the vpper part of his large head [fig. 6.8.9. ᴿ] entring into the *sinus* of the *Talus*, [fig. 4. ᵠ] and againe the heele admitteth into a narrow and almost plaine *sinus* of his own [fig. 7.8.9. ᴿ] the protuberation of the *Talus*: [fig. 9 S] to the Cube bone, it is ioyned on the foreside [fig. 11. R] by his depressed head. [fig 7. ᴿ] *His vse.*

The lower part of the Heele [fig. 2. ˣʸᶻ] is somewhat broad that the foote might stand more safely; rough also and vnequall because of the muscles. It hath a rough [fig. 2. ʸ ᶻ fig. 8 ʸ fig. 9. ᶻ] and transuerse processe running from behind downeward, from whose foreside ariseth the muscle which bendeth the second bones of the foure Toes, and the fleshy portion, from which are produced the muscles which leade the foure Toes to the great Toe: wherefore within the processe there is a cauity least when the foot is fastened vppon the ground, the heads of these muscles should be compressed.

The head of the heele or the vpper part thereof in children hath an Appendix, and is like a round body, hauing a light impression raysed with a little ruggednes, [fig. 7.8.9. ᵃᵇ] into which impression the Ligaments of the shanke bone and of the *pasterne* are inserted. On the backside this vpper part is depressed and rough on either hand, [f. 2.8.9. ᶜ] in which depression and asperity the greatest and strongest tendon of the whole body, that is, of the first, second and fourth muscles of the foote is inserted. On the foreside it hath rough and deepe bosomes, [figure 7. v v] which with the bosomes of the *pasterne* are filled with gristles.

The sides of the heele are broad and depressed. The inside [fig. 2.8. ᵈᵈ] is smmoth and notably sinewated; in the middest are three inscriptions [figure 2.8. ᶜ] to make way for the tendons of the fift muscle of the foote, and the two benders of the last ioynts, which passe that way vnto the sole of the foote: that way also passe the veines, arteries and nerues, which are also defended by the processe of the heele which maketh the inside of the heele very deepe.

The

Table 25. *Sheweth the bones of the Foote properly ſo called.*
Fig. 1. & 2. *ſhewe the bones of the right foote faſtened together their vpper face and their neather face.*
Fig. 3.4.5 & 6. *ſhewe the vpper, lower, inner & outer ſides of the Talus or paſterne.*
Fig. 7.8.9. *ſhewe the ſame ſides of the Heele.*
Fig. 10. & 11. *ſheweth the forward and backward ſide of the boate-bone.*
Fig. 12. & 13. *ſhew the fore and backepart of the wreſt made of foure bones.*

TABVLA. XXV.

A B C D 3,5,6, The protuberation of the *Talus* ioyned to the appendix of the leg-bone, and of this protuberation foure ſides.
E E 3, A *ſinus* inſculped in the protuberatiõ of the *Talus*.
F F 3, two bunching parts of the protuberation of the *Talus*.
G 3, the innhr ſide of the protuberation of the *Talus* curſted ouer with a griſtle, ioyned to the inner ankle.
H 6, The outward *ſinus* of the protuberation of the *Talus* couered ouer with a griſle, and receiuing the inner ankle.
I 5, A rough *ſinus* of the *Talus* receiuing a griſtly ligament from the inner ankle.
K 6, a *ſinus* of the *Talus* receiuing a griſtly ligament from the outward ankle.
L M 5,6, two *ſinus* in the hinder part of the *Talus*
N 3,4,5,6, the neck of the *Talus* or paſtern bone.
O 3,4,5,6, the head of the *Talus* going vnder the *ſinus* of the boate bone.
P 7, 8,9, The head of the bone of the heele cruſted ouer with a griſtle and going vnder the *ſinus* of the *Talus* or the paſterne bone.
Q 4, a large *ſinus* of the *Talus* receiuing the head of the heele.
R 7,8,9, a *ſinus* of the heele whereto the lower part of the head of the *Talus* is ioyned.
S 4, the lower part of the head of the *Talus* going into the *ſinus* of the heele.
T T 4, a ſharp *ſinus* of the heele receiuing a griſtly ligament from the paſterne bone.
X Y Z 2, the place of the heele.
Y Z 2, Y 8, Z 9, a proces of the heele made for the production of muſcles.
a b 7,8,9, from *a* to *b* the diſtance of the vpper part of the heele.
c 8,9, the hinder part of the heele.
d 2,8, the inner ſide of the heele.
e 8, the place where the tendons that run to the bottom of the foot are reflected.
f 7,8, the vtter ſide of the heele.
g 1,7,9, here the tendons of the 7 and 8 muſcles of the foote are ſtrerched out.
h 7, the fore part of the heele which is ioyned to the paſterne bone.
i 7, that part of the heele which is ioyned to the Cube bone.

k 11, The *ſinus* of the Boat-bone receiuing the head of the *Talus*. *l m n* 10, three ſurfaces of the Boate bone lightly prominent, which are articulated to the bones of the wreſt. *o p* 11, the vpper part of the Boatbone regarding the top of the foot. *q r* 10, & *q* 11, his lower part. *q* 10,11, A *ſinus* through which the fixt muſcle of the foote is led. *ſ t u* 13, the plaine ſurfaces of the three inner bones of the wreſt whereby they are articulated to the Boat-bone. *x* 13, a ſhallow *ſinus* of the Cube-bone whereby it is articulated to the heele. *α β* 12, the place of the Cube bone to which that bone of the Afterwreſt is ioyned which ſupporteth the laſt Toe ſaue one. *γ* 12,13, the place of the Cube bone where the third bone of the wreſt is articulated. *δ* 12 13, that part of the Cube bone which reſpecteth the outſide of the foote. *ε* 12,13, the ſurface of the Cube-bone in the vpper part of the foote. *ζ* 2,13, that part of the Cube bone which reguardeth the earth. *η* 2, A *ſinus* of the Cube bone at which the tendon of the ſeauenth muſcle of the foot is reflected. B 13, a proceſſe of the third bone of the wreſt whereinto the fift muſcle of the foot is inſerted. *ι* 12, the place of the inner bone of the wreſt to which that bone of the Afterwreſt which ſuſtayneth the great Toe is coupled. *κ* 12, the place of the ſecond bone of the wreſt whereto the bone of the Afterwreſt that ſupporteth the fore Toe is articulated. *λ* 12, the place of the third bone of the wreſt whereto that bone of the Afterwreſt which ſupporteth the middle Toe is articulated. *μ* 12,

μ,1,2, A ſmall bone whereby that bone of the Afterwreſt which ſuſtaineth the little toe is ioyned vnto the Cube bone. νν,1,2. the diſtances betwixt the Bones of the Afterwreſt. ξξ,1,2, the heades of the bones of the Afterwreſt which enter into the boſomes of the toes. π,2, A proceſſe of the bone of the afterwreſt whereinto the tendon of the ſeauenth muſcle of the foote is implanted. ϒ2, A proceſſe of the Bone of the Afterwreſt, which ſuſtaineth the little toe, which proceſſe receyueth the tendon of the eight muſcle of the Foote. ς,τ,υ,1,2, the three Bones of the foretoe. ϕ,φ,2, two ſeede bones placed vnder that bone of the afterwreſt which ſuſtaineth the great toe. *2 vnder *X*. A Seede bone ſet to the ſecond ioynt of the great Toe. r,1,2, The *Talus* or paſterne. Δ,1,2, The Heele. Θ,1,2, the Boat bone. Λ,Ξ,1,2, The bones of the toes Φ,X,1,2. Two Bones of the great toe. I,II,III,IV,V,1, The fiue Bones of the Afterwreſt. 1,2,3,4. In fig.1,2,12,13, The Foure Bones of the *Tarſus* or the Wreſt. Char.1. in fig.12 &13, the greater wedgbone or the fift Bone of the wreſt. Char.2. fig.12,13, the leſſer wedge bone or the ſixt bone of the wreſt. Char.3. fig.12,13, the middle wedgebone, or the ſeuenth bone of the wreſt. Char.4 fig.12,13, The Cube-bone.

The outſide [fig.2,9 Z] is depreſſed, rough and vnequall, out of whoſe lower part yſſueth the muſcle which leadeth the little Toe from the reſt, but in the foreſide there is a little ſinus [fig.1,7,9 S] cruſted ouer with a Griſtle, which we meet withall vnder a ſmal proceſſe, and through this ſinus the tendons of the ſeuenth and eight muſcles of the ſole do paſſe and are reflected vnto the backſide of the vtter ankle. That part of the heele that is next the little Toe is on the foreſide ſmooth by reaſon of a griſtle wherewith it is cruſted ouer, and the vpper part ſhooteth out a large head raiſed ſomewhat high, by which head the heele is articulated into a ſinus of the Cube-bone almoſt plaine, [fig.1,2 Θ] belowe it hath an oblique Sinus bending inwarde, which receyueth a part of the Cube-bone.

The third bone of the wreſt [figu.10,11] is called by the Grecians σκαφοειδὲς *Nauiforme*, *Os Nauiculare Cymba* the Boat-bone, becauſe it is long, deepe, behinde hollowe, before and in the vpper part gibbous, [fig.1,°P] in the lower part hollow [fig.10,11,qr] This *Bote-bone* is ſeated in the inſide of the foote, and by the mediation thereof, the greateſt part of the wreſt is ioyned to the *Talus*. For on the backſide it hath a Sinus [figure.11,k] deep and tranſuerſely long, [fi.1 olmn] in which the head of the *talus* [fig.3,4,5,O] is inſerted, and this articulation muſt be referred to an obſcure *Enarthroſis* or *Inarticulation*, becauſe the motion thereof is obſcure. The other part hath a long head bunching out, and diſtinguiſhed with a threefold ſuperficies or ſurface [fig.10, l m n] to which the three laſt bones are articulated, [fig.1,2,12,13. char.1,2,3] but becauſe they are very ſmooth, it is to be doubted whether they receiue or are receyued. The 3. bone of the Wreſt.

The outſide of this Boate-bone is large, round and ſinuated [fig.10, qr and 11q] eſpecially where it is ioyned to the fift bone. Preſently after, it is anguſtated by degrees, and endeth into an internall narrow proceſſe [Fig.10,q] reſembling the prow of a ſhip. The inſide is prominent, ſo that it maketh a notable protuberation, which protuberation maketh the lower Sinus [Figu.10,11 q] ouer which it hangeth much greater vvhere the tendon of the ſixt muſcle of the foote is reflected. Finally this Boat-bone is rough aboue and below, that from thence the Ligaments might yſſue which tye this bone to the *Talus*, and the bones of the wreſt of the foote.

Theſe three bones whereto there is nothing aunſwerable in the hand, and are as it were the baſis of the leg, the Ancients haue not numbred among the bones of the wreſt of the foote. There follow other foure, which ſay they, do alone make the *tarſus* or wreſt, and are like vnto the wreſt of the hand; for being ioyned together by Ligamentes, they make as it were an Arch, whoſe vpper ſuperficies is conuexe, & the lower concauous or hollow: for the Cube-bone is ioyned to the heele, and the three following to the Boate-bone, and with them are together lifted vp from the earth, for ſuch a conſtruction as this is ſtronger both for the faſtening of the foote and ſuſtaining of the hodye, for an arched building is more ſtrong and laſting. Theſe bones alſo were neceſſarily prominent, that vnder ſuch prominences a cauity ſhould be left, wherein as wel the tendons of thoſe muſcles ſhould be ſecured which run vnder the ſole, as alſo the muſcles themſelues which ariſe from the lower part of the wreſt, and are directed to the toes of the foote: for if the ſole had bene plaine, the Muſcles with their tendons would haue bene compreſſed, and ſo neither could a man haue trauelled without paine, and beſides the muſcles had beene kept from performing their office in flexion and extention.

Moreouer, where theſe bones are ioyned one to the ſides of another, they are not couered ouer with griſtles, ſauing onely where they beare vppon the Boate-bone. Otherwhere they are coupled with griſtly Ligaments. They are alſo without appendices, and

their ſubſtance is like the ſubſtance of the paſterne and Boat-bones. They differ alſo in quantity and figure, [conferre Fig.1 with 2. and 12 with 13] for the two firſt are far greater then thoſe two in the middeſt, and are ioyned to the foure bones of the *Pedium* or After-wreſt, but we will intreate of them particularly.

The 4. bone. The fourth bone of the wreſt [Fig.12,13.char.4] is called in Greeke κυβοειδὴς *Os Cubiforme* from the forme of a Dye, becauſe it hath as it were ſix ſides. It is alſo called πολύμορφον *Os Miltiforme*, becauſe it hath diuers formes, the Arabians call it *Grandinſoum*. This bone on the outſide of the foote is placed before the heele. It is greater then the reſt, & the firſt ſide of it [Fig.13 *] is ioyned behinde to the heele [Fig. 7, i] with an vnequall ſurface and reſteth vpon the ground, and it is doubtfull whither it receyue or be receyued. *Archangelus* affirmeth both: the ſecond ſide, [figu.12 αβ] before is ioyned with a continuall ſuperficies to the fourth and fift bones of the After-wreſt, and ſupporteth them like a baſis: the third ſide is inward [fig.12,13 γ] and articulated to the ſeauenth bone of the wreſt; the fourth ſide is outward [fig.12,13, d] and obſcurely plaine, neither doth it ioyn to any bone, no more then the two following ſides do, for the fift ſide is aboue plain and rough [fig.12,13 ε] and the ſixt is below. [fig.2 ζ η fig.3 ζ] Finally, the latter end or extremity of it hath a proceſſe diuided by a middle ſinus, [fig.2, η] which is long and oblique, whereat the tendon of the ſeuenth muſcle of the foote is reuolued.

The 5. bone. The fift bone of the wreſt [Fig.12, char.1, fig.13 f] as alſo the two following, are called in Greeke χαλκοειδῆ *Cuneiformes*, becauſe they are like wedges. This fift, occupyeth the inſide of the foote, and is ſeated ouer againſt the great toe. On the foreſide it is ſinuated [Fig.13, γ] to receiue a portion of the proceſſe of the Boatbone; behind, it receiueth the firſt bone of the *pedium* or Afterwreſt, and it is vncertain whether it be ſinewated or prominent, which vncertainty is common to the backeward bones, as they are coupled either one with another, or with the bones of the After-wreſt, ſo that they ſeeme to be conioyned by *Ginglymos*, becauſe they haue obſcure Sinus or boſomes, notwithſtanding this part ſeemeth to haue two ſmall knots or protuberations, becauſe the bone of the Afterwreſt carrieth the ſhew of a double cauity: the vpper part is but ſmall and a litle conuex, whereby it is ioyned to a ſhallow or ſuperficiary Sinus of the ſixte bone: the lower ſide is thicker, that it might reſt faſter vpon the ground.

The 6 bone. The ſixt bone of the wreſt [fig.12,13.char.2,7] is called *Cuneiforme minus*, the leſſer wedge, and if you regard the vpper part which looketh toward the foote it is broade, ſomewhat arched, and as it were foure-cornered. If you reſpect the lower part which looketh toward the foote it is very narrow and edged, and ſo reſembleth a wedge, as alſo doth the ſeauenth which is next vnto it, for they both ſeeme to be like wedges interpoſed amongſt the reſt to ioyne them the faſter together. This ſixt bone behind is ioyned to the Boate-bone: [Fig.13 e] before it lightly buncheth out and is faſtened to the ſecond bone of the After-wreſt; [Fig.12 κ] on the inſide it is ioyned with the outſide of the fifte bone of the wreſt, and on the outſide with the outſide of the ſeuenth.

The 7 bone. The ſeuenth bone of the wreſt [Fig.12 & 13.char.31] is called *Cuneiforme medium*, the middle wedge, and is ſeated betwixt the fourth and the ſixt. It is ſome-what like a Quadrangle but longer, for on the backſide it hath a ſmall ſinus [Figu.13, a] which receyueth the protuberation of the Boat-bone: on the foreſide it admitteth the thirde bone of the Afterwreſt, [Fig.12 λ] and the ſides of it touch the ſides of the ſixt and the fourth Bones. And thus it is placed amongſt the bones like a wedge: below it ſwelleth out with a protuberation, [Fig:13, β] whereinto the fift muſcle of the foote is inſerted.

[The twelfth Figure ſheweth the anteriour face of the foure bones of the wreſt, of the foote faſtened together, the thirteenth Figure ſheweth their backſide]

CHAP. XXXVII. *Of the Bones of the After-wreſt, and the Toes of the Feete.*

The afterwriſt of the foote. THE ſecond patt of the Foot is called μετάτιον by the Grecians, by *Celſus Planta*, the tread of the Foote, by others *pecten*, and by others *Matatorſum*, becauſe it is anſwerable to the *Metacarpium* in the hand, we will call it *the Afterwreſt of the Foote.* [Tab.25.fig.1, Char.I,II,III,IV,V] It is compounded of fiue bones which are articulated to the Bones of the *Tarſus* or wreſt, and do ſuſtaine the bones of the Toes. To the *Tarſus* or wreſt they are ioyned by ſome-what plaine and ſmooth ſuperficies. [Fig:12,2, κ, λ, α, β]

The

The first which is placed before the great toe, is *adarticulated* to the inner bone of the wrest; that which is placed before the next to the great toe, is ioyned to the second bone of the wrest; that which is placed before the middle toe to the third, [fig. 2 betwixt ρ σ] the other two are adarticulated to the Cube-bone. [Fig. 2 neere ρ and π] And as the bones of the VVrest of the foote are not placed on the foreside in a right line, so of the bones of the After-wrest one enclineth more backward then another. Notwithstanding, they stand in one order or ranke as do the bones of the Toes, which maketh much to stability and firmitude.

They are long bones and round, and end on both sides into heads. For where they are articulated with the bones of the wrest they are thicke and sinewated and ioyned together by their sides, where they recede or depart by degrees one from another, they become slender and leaue a distance betweene them for the Muscles called *Interossei*, which wee called the *Bone-bound* Muscles. But their lower heads which are inserted into the deepe bosomes of the first ioynts of the Toes [fig. 1, 2 ξ in φ] are orbicular, and on the backside encreased with an Appendix. The heads of these bones are more diuided towards the vpper part and lesse toward the lower, quite contrary to that it is in the handes, and the reason was because in detxention it behooued that the Toes of the feete should be more eleuated then the fingers of the hand, which kinde of articulation we call *Enarthrosis* or *Inarticulation*.

The first of these that is set before the great toe, is the thickest of them all & the shortest, hauing a rounder head, that so the great toe might bee better mooued to the sides then any of the rest. In the lower part vnder the heade, where it is articulated vvith the *Tarsus* or wrest it buncheth out into a processe [fig. 2 σ] wherevnto is inserted the tendon of the seuenth muscle of the foote, and at the same place there are two Seedebones greater then the rest, and crusted ouer with a gristle. The first.

The second bone of the Afterwrest which sustaineth the foretoe is the longest, vnlesse it be the fist which sustaineth the little toe; for the length of this last is encreased by a notable processe, [figure. 2 ρ] whereby it was articulated to the wrest, because it was to bee lengthned into the outside of the foote to make a place of implantation for the tendon of the eight muscle of the foote. These bones of the Afterwrest aboue and belowe, haue Appendices crusted ouer with gristles: their substance also and their cauity which conteyneth their marrow is answerable to the substance and cauity of the bones of the Afterwrest of the Hand. Moreouer they are thrilled with small holes, by which little veines and arteries, as in other bones, do passe in to nourish and cherish them. The Bones of the Toes.

After the bones of the Afterwrest doe follow the bones of the toes which make the third part of the foote and are in number fourteene [fig. 1 ^ z. fig. 2 Λ, z] for euerie one of them consisteth of three bones, as it is in the fingers of the hand excepting the great toe; [fig. 1, 2, ς τ υ] and indeed their substance, structure and situation is litle different from the hād, sauing that the first ioynts haue a deeper sinus becausse the deeper heads of the bones of the *Pedium* or Afterwrest are inserted into them. And although the heads of the bones of the foot are large, yet is not their sinus so large as in the hands, that so in extention the toes might be more lifted vp, and yeeld something to the ground vpon which we stande. The great toe is formed of two bones [fig. 1 φ χ] that the foreside of the cauity of the Afterwrest might more firmely rest vpon the earth. All these Bones aboue and below haue Appendices, and are crusted ouer with strong gristles to make the ioynt more glib which is articulated by *Ginglymos*, alwayes excepting the last bones of the toes, which are not articulated to any other bone, but haue nayles cleauing vnto them. Note also, that the knuckles of the toes are shorter then those of the hands, gibbous aboue and hollowe belowe, the better to admit the Tendons of the muscles which bend the second and thirde ioynts. Againe, the first bones are greater then the second, and the second greater then the third, and the middle bone in foure toes seemeth to be square. In like manner, the bones of the great toe are thicker then the bones of the thumbe: the rest of the bones of the toes are lesser then the bones of the fingers. Finally, the bones of the toes are also full of marrow.

CHAP. XXXVIII. *Of the Seed-bones and the Nayles.*

THE Seed-bones [t. 25 f. 2 ϟ ω] are of the same number and position with the Seedebones in the hands, that is to say twelue, and they are so much lesse and lesse conspicuous in the toes then they are in the fingers, as the fingers are greater then the toes: not-

withstanding as the great toe hath greater bones thē the thumb, so also are his seedbones larger. Wherefore at the first ioynt of the great toe nere the head of the bone of the Afterwrest which is articulated to that ioynt, there are two notable seede-bones which lye vnder the nerueous part of the muscle which bendeth the first bone of the great toe: and of these the inner is bigger almost by halfe then the other, yea as big as half a great pease when the husk is off, and not much vnlike it. This bone the Arabians call *Albadara*, and they say (how foolishly let the Diuines speake) that of this bone as it were of seed a man receyueth the new body wherewith he riseth at the resurrection; that which lieth vnder the second ioynt of the great toe and is much lesse then the former, leaneth vppon the tendon of the muscle which bendeth the second bone of the great toe.

Cōcerning the rest of the seedbones, they are disposed as is said in the history of the hand.

2 Seed bones in the Hand.

To this place wee thought good to refer two small bones found in the Ham neere the thigh-bone, and growing to the heads of the two first muscles which mooue the Foote. These bones, saith *Vesalius*, are found in Harts, in Dogs, and Hares, and such like dry creatures, yea in old men also. Their surface is slippery and regardeth the vpper part of the lower heads of the thigh, to which bones this is peculiar, that they do not leane vppon the tendons of the muscles as other seed-bones do, but vpon their originals, like as doth the bony part which in old men is fastned to the Cube bone, which bony part we meet withall in the tendon of the seauenth muscle of the foote there reflected.

Furthermore, as we said before, that to the outside of the ioynt, whereat the bones of the Afterwrest which sustaineth the little finger is fastned to the wrest, there is a small bone annexed, so also in the foot at the outside of the articulation of that bone of the Afterwrest of the foote which supporteth the little toe [ta.25.f.1,2,&] where the fifte bone of the Afterwrest is articulated to the Cube-bone, there is also found a small bone at the insertion of the tendon of the eight muscle of the foot.

Their vse.

These seed-bones, although they seem to haue the same vse that they haue in the hands; yet moreouer in the foot they are the cause why whē we stand or walk, whether the place be tough or smooth, the foot applies it selfe more equally vnto the earth: as also to keepe the toes when we stand or walke, from being luxed by stones or any other eminent thing we should light vpon. Finally, the extremities or ends of the toes as it is in the Fingers, are couered and defended with nayles fastned to the skin on the outside, of which we will add a few words.

The Nailes.

The Nayles are called by the Grecians ὄνυχες, their root ῥίζονυχίαι, the bottome of white moone λευκωλή, and the filme that groweth to the root ἀρχεμαφή. There are diuers opinions concerning the matter of the Nailes: some thinke, it is a glutinous moysture parched and dryed by the heate, and driuen vnto the extreame parts, and therefore saith *Hippocrates* are the nailes exceeding fast and thight, beecause their matter is baked together. Secondly *Empedocles* conceiued, that the nails were made of nerues by congealation, and therefore *Fœsius* in his notes vpon *Hippocrates* cals the nailes *Neruorum clausulas summas*, the terminations of the nerues giuen by Nature to make vp and establish the extreamities of the body, and therefore if they faile or fall away it is a signe of great weakenesse. Thirdly *Aristotle* in the sixt chap. of his 2 book *de generatione animal.* saith, that the nailes, the hayres, hornes, beakes of birdes, hooues and such like are engendred of adiacentitious aliment. Fourthly *Columbus* remembers, that some thinke the nailes are amassed of a part of a bone of a nerue of skin, yea some say also of flesh, but he doth not easily subscribe to their conceite.

Diuers opinions of their generations.

Columbus saith, they take their originall partly from the skin, partly from the tendons of the muscles which extend the Fingers and the toes. *Bauhine* saith, that some conceyue them to arise from the crasse excrements of the third concoction, and therfore that they continually grow by an imperfect acretion, made by the appositiō onely or addition of Aliment, whence, say they, it is that they grow onely in length, not in bredth or depth, and therefore are to be excluded out of the number of liuing parts; notwithstanding *Galen* in his booke *de Admin. Anatom.* witnesseth, that there is conueyed to the roots of the nailes, a vein, an artery and a nerue, by which they receiue aliment, life and sense, as other parts do. And truly, not onely two Nerues are conueyed vnto the roots of the nailes, but also do creepe vnder the nailes together with the veines vnto the very top of the Finger: yet we do not say that the nailes haue sense, because they are not distributed throughout the substaunce of the nailes, no more then are the veines which vnburthen themselues of the Aliment at the roote of the naile. We conclude therefore that the nailes are encrea-

sed

sed like the teeth by an appositon of aliment to their roote, which was the best way, because they were euery day worne and therefore had more neede to bee restored in theyr length then in their bredth and thicknesse.

Their substance is of a middle Nature betwixt bones and gristles moderately hard, the better to beare the violence of outward iniures, flexible or buxome that they should not breake but giue way to violence, pellucide or transparant and therefore they are either red or liuid according to their flesh vnder them: thin they are and conuex, that they might lye more snogly vpon the fingers, and this also maketh much for their security; for if they stood off from the flesh they would easily be torn from their roots. Again, to make them more stedfast, they are fastned at their root with a Ligament, & because they must needs grow to the flesh and the skin, therefore the skinne on the outside compasseth the root round, but the flesh groweth to them more inward. Vnder the nailes as far as to the very extremities or ends of the fingers the tendons of muscles doe passe and are dilated vnder them, which thing, saith *Columbus*, I first obserued. And this is the reason why the part vnder them is of so exquisite sense, and the pain so great if any sharpe splinter or such like do get vnder the naile. Their substance.

The vse of the nailes is to defend the end of the fingers which are very softe, that they be not offended by outward occurrents: their hardnesse therfore giueth a firmitude vnto the softnesse of the flesh. Againe, the hands had nayles for better apprehension, for wee could not haue taken hold of many small things vnlesse there had bene fastned some hard body to strengthen & establish the fleshy extremities of the Fingers, which must bee also sharpe or edged to enclose a fine and slender bodye, that otherwise would haue slipped from betwixt them. The Toes had nayles to couer and defend their extremities, & beside in station to beare the Toes against the ground with more resistance. As for scratching or clawing, or any such other vse of the nailes, we thinke it to be of the *by* and not of the *Maine*. The Vse.

Thus at length haue we, through the diuine assistance, brought vnto end a long and painfull labour, worthy indeede to haue bene vndertaken by a man of more sufficiencie and of greater experience in this Art then I would haue my selfe esteemed to be; my Age and Meanes not affoording me time or opportunities to do that which I haue earnestlie euer affected. But for recompence of these Defects (gentle Reader) I haue pressed the footsteps of the best and most approoued Authors; wherein as my first and most simple intent was the bettering of my owne knowledge in so necessary a part of my profession, so being perswaded that thy profit might fall in with the same, I haue set before thee a Mirrour, wherein thou mayst see the true representation of thine owne Originall, Structure, Growth and Accomplishment; & learn thereby to giue the glory and profit of thy Creation, to him that acording to his mighty vvorking did first poure thee forth as a few drops of Milke and after curdled and sammed thee vppe into so exquisit a forme as thou art become the most wonderfull of all his workes of wonder. To him therefore so admired and propitious a Creator, ascribe with me all honor and praise, and consecrate the glorious Temple of thy body, and the Altar of thy Soule vnto that Diety, vvho created them first of nothing, redeemed them when they were worse then naught, and hath promised eternall mansions for them, to partake with Himselfe of euerlasting Felicitie. The Conclusion.

Πάντοτε δόξα Θεῷ.

FINIS.

fed like the teeth by an application of aliment to their roots, which was the best way, because they were euery day worne and therefore had more neede to bee reformed in them by length then in their breadth and thicknesse.

Their vse in fance. Their lofty fance is of a middle Nature betwixt bones and gristles not verie hard, the better to beare the violence of outward injuries, flexible or buxome that they should not breake but giue way to violence, pliable or transparant and therefore they are either red or liuid according to their feeling vnder them: thin they are and counter, that they might lye more snugly vpon the fingers, and this also maketh much for their security, for if they stood off from the flesh they would easily be torn from their roots. Again, to make them more fleshfast, they are fastned at their roote with a Ligament, & because they must needs grow to the flesh and the skin, therefore the skinne on the outside compasseth the roote round, but the flesh groweth to them more inward. Vnder the nailes as far as to the very extremities or ends of the fingers the tendons of muscles doe passe and are dilated vnder them, which thing hath Galen well obserued. And this is the reason why the part vnder them is of so exquisite sense, and the pain so great if any sharpe splinter or prick like do get vnder the nailes.

The vse of the nailes. The vse of the nailes is to defend the end of the fingers which are very tender, that they be not offended by outward occurrences: wherefore therefore put a multitude into the substance of the flesh. Againe, the hands had maruelous fit better apprehension, for we could not haue taken hold of many small things vnlesse there had beene planted some hard body to sustaine & establish the fleshy extremities of the fingers, which must bee also shape or edged to enclose a fine and slender body, that otherwise would haue slipped from betwixt them. The Toes had nayles to couer and defend their extremities, & beside in station to beate the Toes against the ground with more resistance. As for [illegible] ching or clawing, or any such other vse of the nailes, we thinke it to be of [illegible] of the Nailes.

Thus at length haue we, through the diuine assistance, brought vnto [illegible] painfull labour, worthy indeede to haue beene vndertaken by a man of [illegible] and of greater experience in this Arte then I would haue my selfe esteemed [illegible] and Manes not affording me time or opportunities to do that which I [illegible] euer affected. But for recompence of such Defects (gentle Reader) I [illegible] footsteps of the best and most approued Authors, wherein as my fri[illegible] intent was the beutening of my owne knowledge in so necessary a part [illegible] to being perswaded that thy profiting shall in with the same, I [illegible] Mirrour, wherein thou mayst see the true representation of thine o[illegible] ture, Growth and Accomplishment, & learn thereby to giue the [illegible] Creation, to him that according to his mighty working did first p[illegible] drops of Milke and alter curdled and hammed thee vppe into [illegible] are become the most wonderfull of all his workes of wonder. [illegible] mised and propitious a Creator, ascribe with me all honor and [illegible] glorious Temple of thy body, and the Altar of thy Soule vn[illegible] mans hurt of nothing, redeemed them when they [illegible] and hath promised eternall mansion for [illegible] with Himselfe for euerlasting [illegible] Iustice.

FINIS